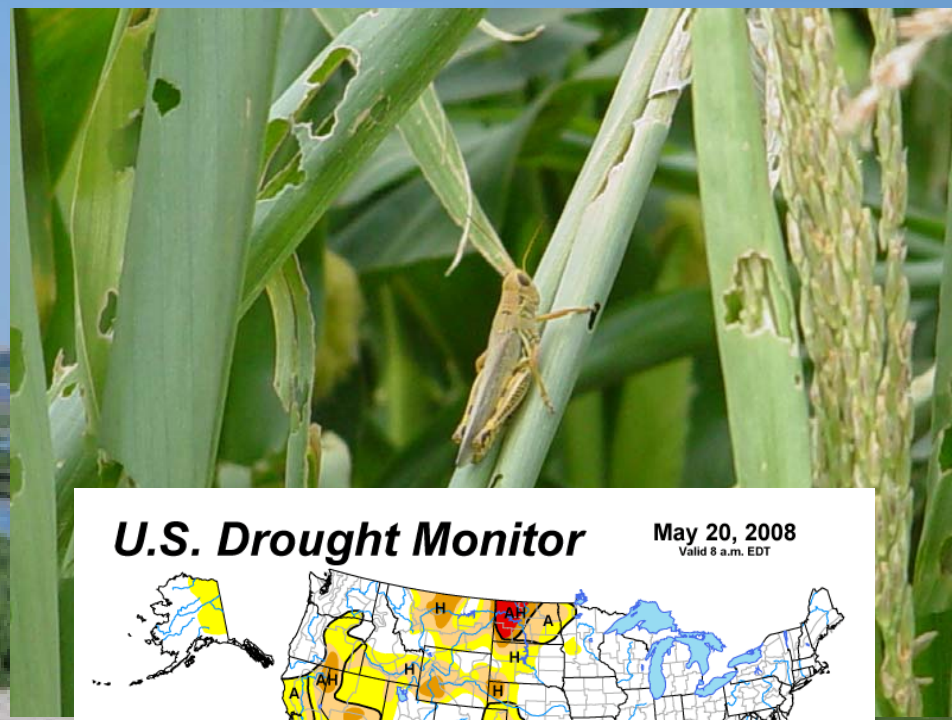
The National Integrated Drought Information System (NIDIS) and the Evolution of a Decision Support System

Brian Fuchs, Climatologist

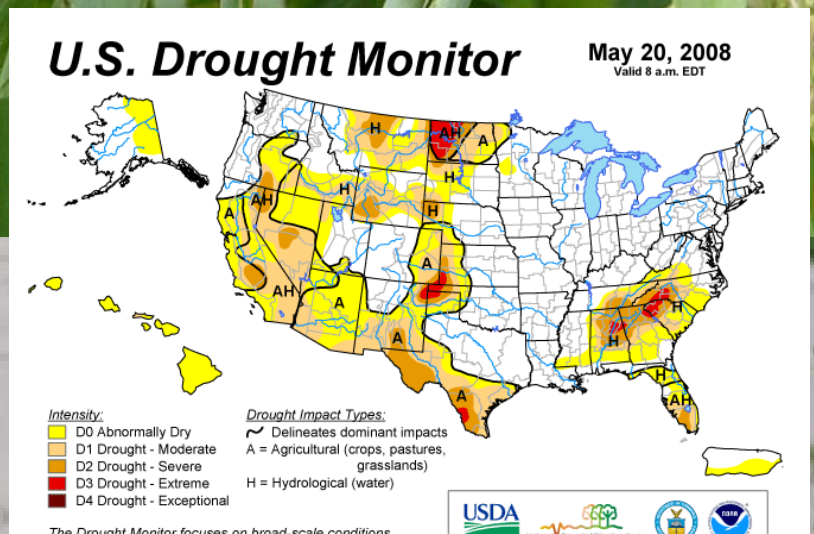
National Drought Mitigation Center

School of Natural Resources

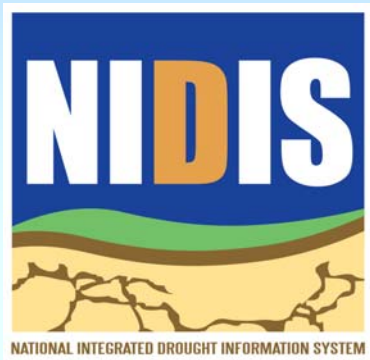
University of Nebraska



Montana Hydrology Conference
Great Falls, Montana
May 27-28 2008



National Integrated Drought Information System: U.S. Drought Portal



Timothy W. Owen[1], Mark Svoboda[2] , Roger Pulwarty[3] , Brian Fuchs[2]

1. NOAA's National Climatic Data Center
2. National Drought Mitigation Center
3. NOAA's Climate Program Office

Montana Hydrology Conference
May 28, 2008
Great Falls, Montana

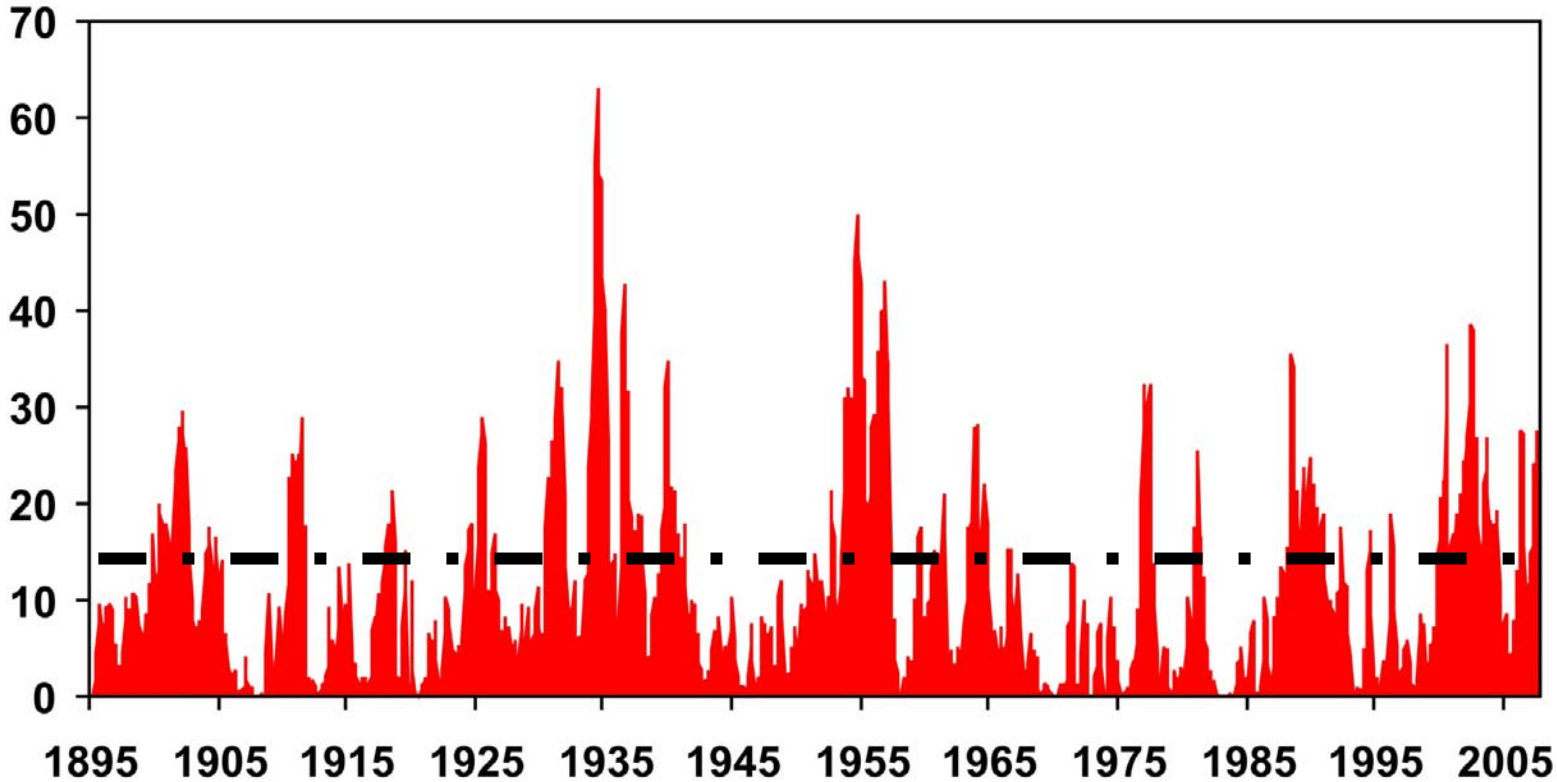
So…What is Drought?

"Drought is a **persistent** and **abnormal** moisture deficiency having **adverse impacts** on vegetation, animals, or people."

- National Drought Policy Commission Report, May 2000

Percent Area of the United States in Severe and Extreme Drought

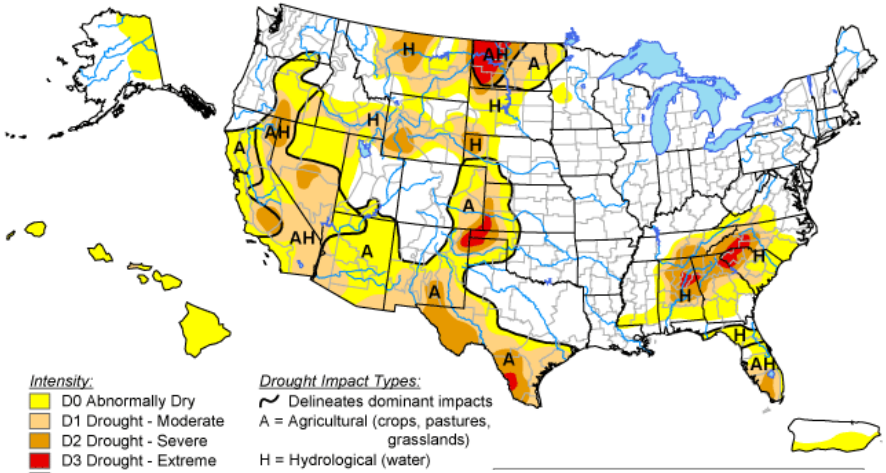
January 1895–November 2007



Based on data from the National Climatic Data Center/NOAA

U.S. Drought Monitor

May 20, 2008
Valid 8 a.m. EDT



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- ~ Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summa for forecast statements.

http://drought.unl.edu/dm

U.S. Drought Monitor

West

May 20, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	32.8	67.2	34.5	6.8	0.2	0.0
Last Week (05/13/2008 map)	33.4	66.6	35.8	6.2	0.0	0.0
3 Months Ago (02/26/2008 map)	37.8	62.2	37.0	16.6	0.0	0.0
Start of Calendar Year (01/01/2008 map)	26.3	73.7	54.7	33.1	2.7	0.0
Start of Water Year (10/02/2007 map)	22.0	78.0	62.3	44.7	12.4	0.0
One Year Ago (05/22/2007 map)	30.9	69.1	51.2	24.4	7.5	0.0

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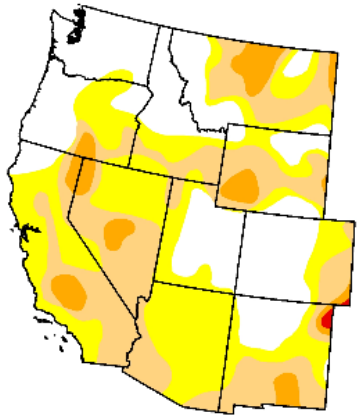

USDA National Drought Mitigation Center

Released Thursday, May 22, 2008
Author: David Miskus, JAWF/CPC/NOAA

U.S. Drought Monitor

Montana

May 20, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	31.0	69.0	45.7	14.7	0.0	0.0
Last Week (05/13/2008 map)	25.3	74.7	54.9	14.7	0.0	0.0
3 Months Ago (02/26/2008 map)	21.8	78.2	51.0	9.0	0.0	0.0
Start of Calendar Year (01/01/2008 map)	0.8	99.2	61.2	26.4	0.0	0.0
Start of Water Year (10/02/2007 map)	3.9	96.1	88.3	46.2	9.5	0.0
One Year Ago (05/22/2007 map)	54.2	45.8	17.4	0.0	0.0	0.0

Intensity:
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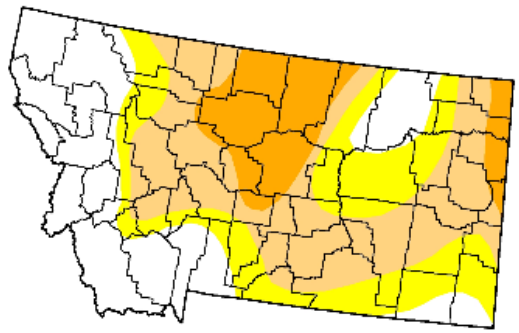

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http://drought.unl.edu/dm

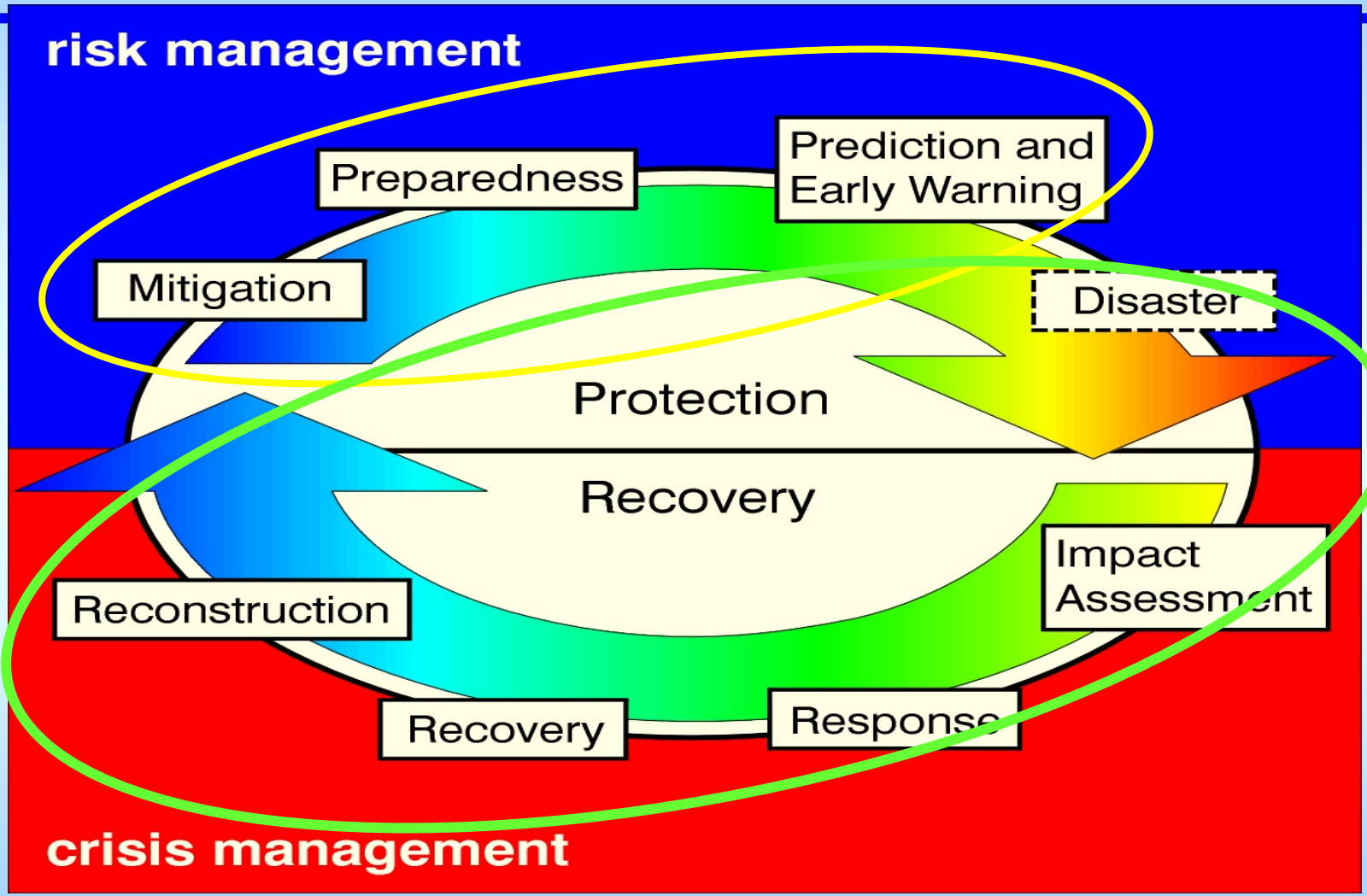
USDA National Drought Mitigation Center

Released Thursday, May 22, 2008
Author: David Miskus, JAWF/CPC/NOAA

Why the Recent Interest in Drought in the U.S.?

- Single and **multi-year** severe droughts
  - impressive intensity and duration
  - impacting both western and eastern U.S.
- Spatial extent—40 to 60% of U.S.
- Complexity of impacts → Vulnerability
  - Agriculture, energy, transportation, urban water supply, recreation/tourism, fires, environmental, social
  - Conflicts between water users
  - Water restrictions (agricultural and urban)
- Costly→Since 1980, $175 Billion in costs associated with drought and heat waves (FEMA)
- Media coverage (extremes)

The Cycle of Disaster Management



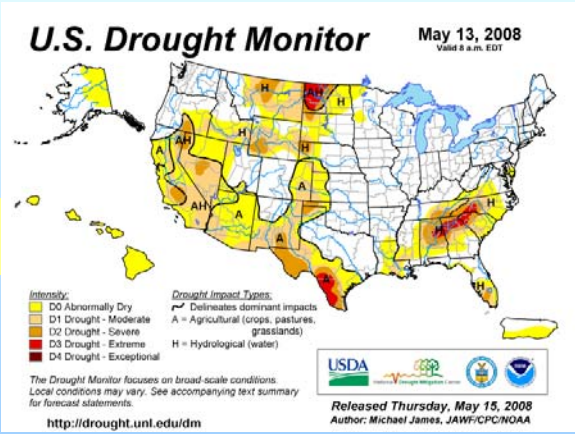
What is NIDIS?

A National Integrated Drought Information System (NIDIS)

National Integrated Drought Information System

NIDIS: An integrated, interagency national drought monitoring and forecasting system that provides:

- An **early warning & forecast system** for drought.
- Drought impact and causation **education.**
- Information for drought **planning and mitigation**.
- An interactive, web-based **drought portal**.
- Improved **observational** capabilities.



NIDIS Builds Upon Collaborative Successes!

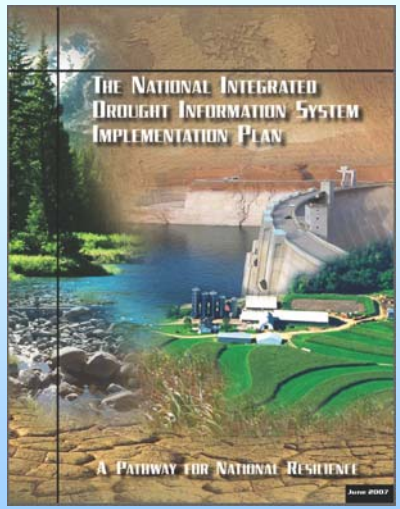
NIDIS Vision and Implementation Plan

A Pathway to Operationalization

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

A ***dynamic*** and ***accessible*** drought risk information system that provides users with the ability to **determine the potential impacts of drought**, and the **decision support tools** needed to better **prepare for** and **mitigate** the effects of drought.

The NIDIS Implementation Plan (June 2007) calls for the establishment of a ***U.S. Drought Portal*** (**drought.gov**) is a key component to realizing this vision.



NIDIS Interagency Partners

Federal Level

U.S. Department of Agriculture (USDA): Agricultural Research Service, Cooperative State Research, Education, Farm Service Agency, Forest Service, National Agricultural Statistics Service, Natural Resources Conservation Service, Risk Management Agency

U.S. Department of Commerce (DoC): International Trade Administration, National Oceanic and Atmospheric Administration

U.S. Department of Energy (DoE): Office of Electricity Delivery and Energy Reliability, Office of Energy Efficiency & Renewable Energy, Office of Science

U.S. Department of Homeland Security (DHS): Federal Emergency Management (FEMA) Directorate

U.S. Department of the Interior (DoI): Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, National Park Service, U.S. Fish and Wildlife Service, U.S. Geological Survey,

U.S. Department of Transportation (DoT): Federal Aviation Administration, Federal Highway Administration, Surface Transportation Board

Environmental Protection Agency (EPA)

Farm Credit Administration (FCA)

Federal Energy Regulatory Commission (FERC)

Internal Revenue Services

International Trade Commission (USITC)

National Aeronautics and Space Administration (NASA)

National Science Foundation (NSF)

Small Business Administration (SBA)

NIDIS Interagency Partners

Regional, State, Tribal, and Local Levels

Western Governors' Association – a key sponsor of early NIDIS development efforts and ongoing concerns representing drought in the Western States;

Western States Water Council – represents water managers in the Western United States;

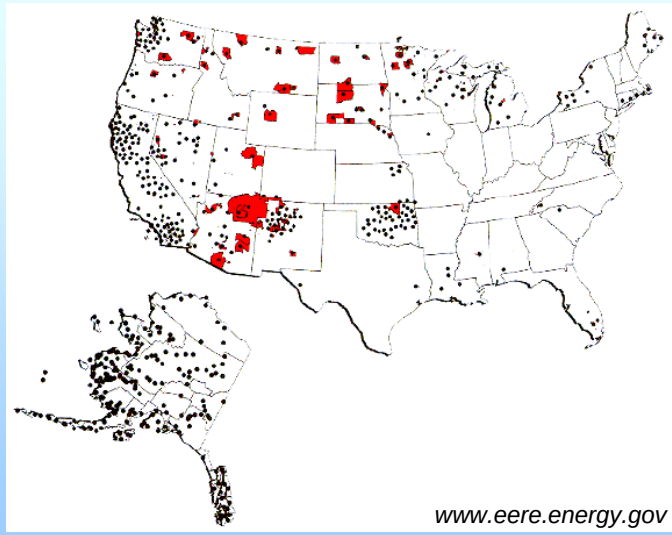
National Conference of State Legislatures – drought monitoring and mitigation activities will require state support, much of which require state legislative involvement

National League of Cities – water availability and quality issues

American Association of State Climatologists – an organization state-appointed individuals, many of whom are active participants in the Drought Monitor or serve on drought monitoring committees within their respective states. Most are housed at universities and also conduct applied climate research;

National Drought Mitigation Center – A national clearinghouse for drought-related information, research, mitigation measures, and operational home of the Drought Monitor;

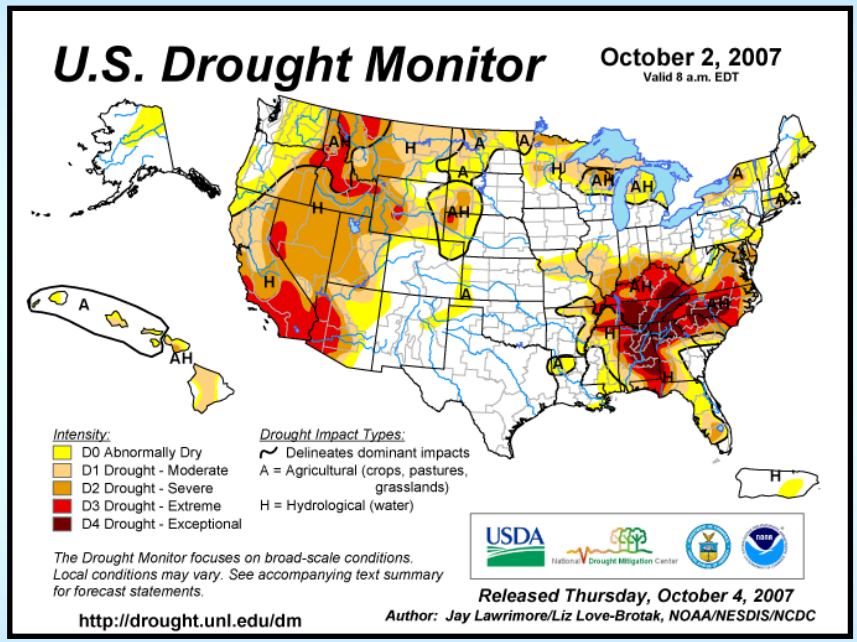
Native American tribal governments – mostly located in arid regions in which water is a vital concern:



www.eere.energy.gov

Drought Early Warning System

- **The U.S. proposes the development of a Drought Early Warning System that will:**
  - **provide accurate, timely, and integrated information on drought conditions and associated risks at relevant spatial scales to facilitate proactive decisions**
  - **present needed information for drought response, planning, mitigation, and recovery**
  - **support the capability to provide data and information required for local, regional, and national decisions on drought**
  - **aid local, regional, and national decisions regarding human and environmental health & welfare during drought**



U.S. Drought Monitor

Drought Early Warning System Benefits

Preparedness: Historical information used to minimize drought related risk (examples)

- Allow planners and policy makers to develop optimal procedures and associated actions from drought impacts

Response: Drought occurs somewhere on the planet every year & can persist for years.

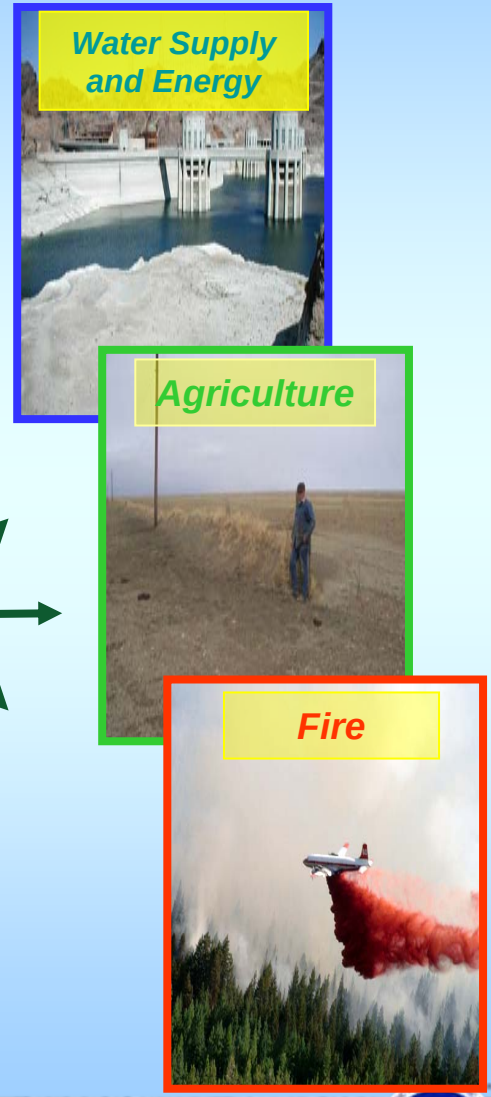
- System will provide the quantitative information necessary for timely and measured response

Mitigation: A myriad of problems stem from drought. (examples)

- Water supply, water quality, agriculture, energy production, fire, human health, etc.
- Information for planning mitigations supported by a comprehensive analysis of drought severity

Recovery: Critical drought information

- Enables countries to access more comprehensive tools and observations for emergency managers and planners



U.S. Drought Portal Home Page

Showcase Portlets and Key Themes

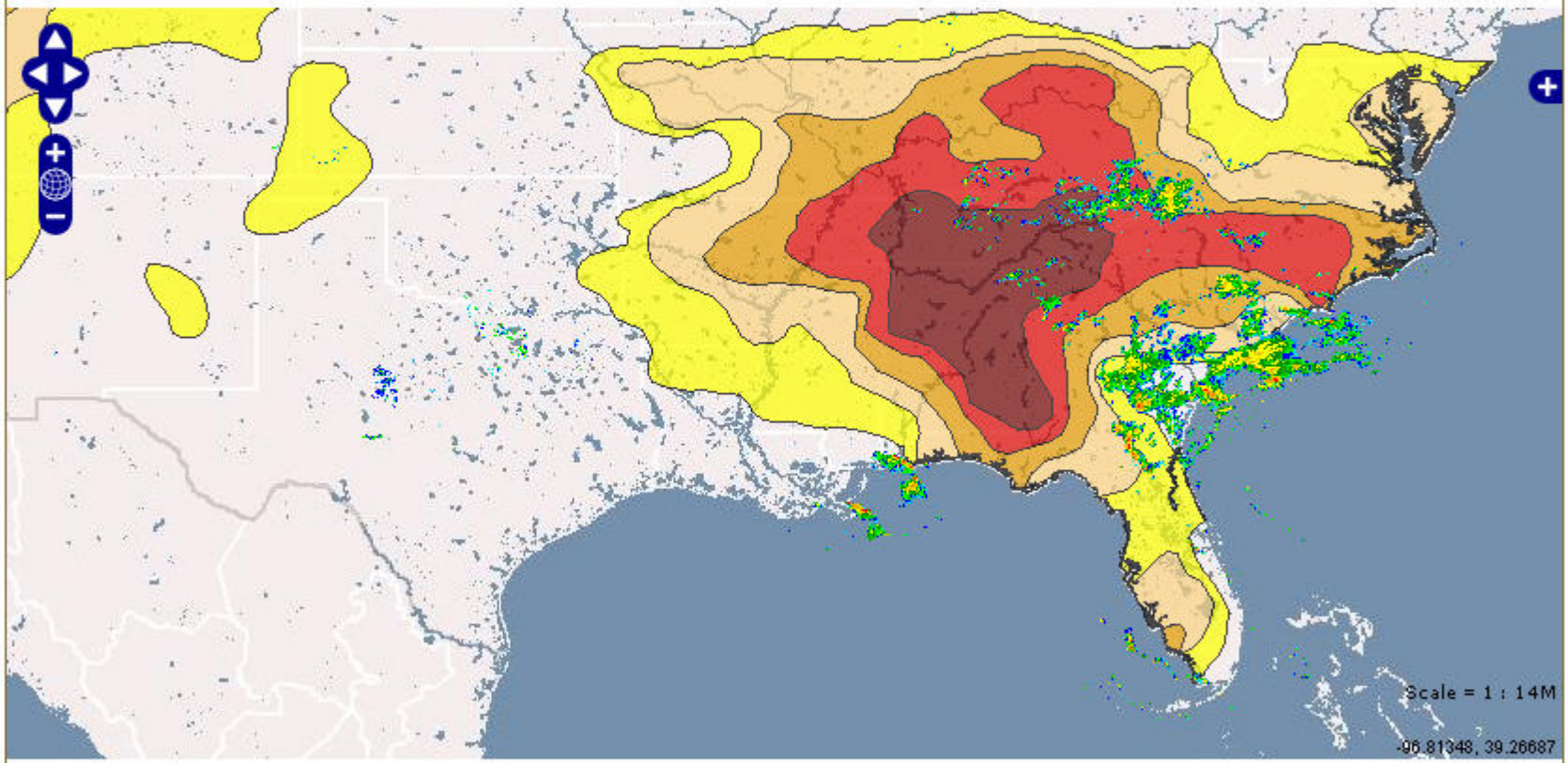
http://drought.gov

USDP Map Viewer

National Climatic Data Center (NCDC)
NOAA Satellites and Information

This USDP Map Viewer displays the 45 Minute NEXRAD Precipitation Radar. Use the + below to switch between available layers including divisional drought, precipitation and temperature data.

View Divisional Data Layers By: State



Hide/Display Legend

Hide/Display Opacity Controls

NIDIS Corn Opacity: << 0.3 >> NIDIS Poultry/Hogs Opacity: << 0.3 >> USDM Opacity: << 0.7 >>

NIDIS

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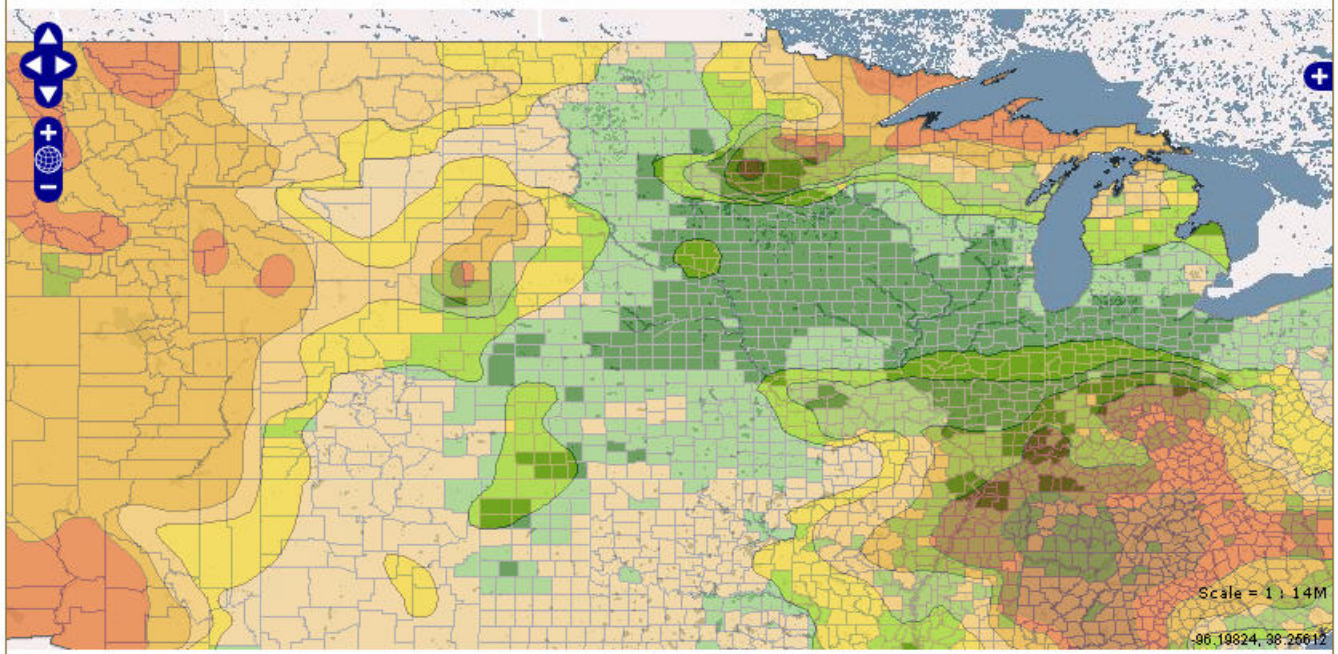

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Hide/Display Opacity Controls

NIDIS Corn Opacity: << 0.6 >> NIDIS Poultry/Hogs Opacity: << 0.3 >> USDM Opacity: << 0.7 >>

(For more advanced GIS features, visit NCDC's GIS Portal)

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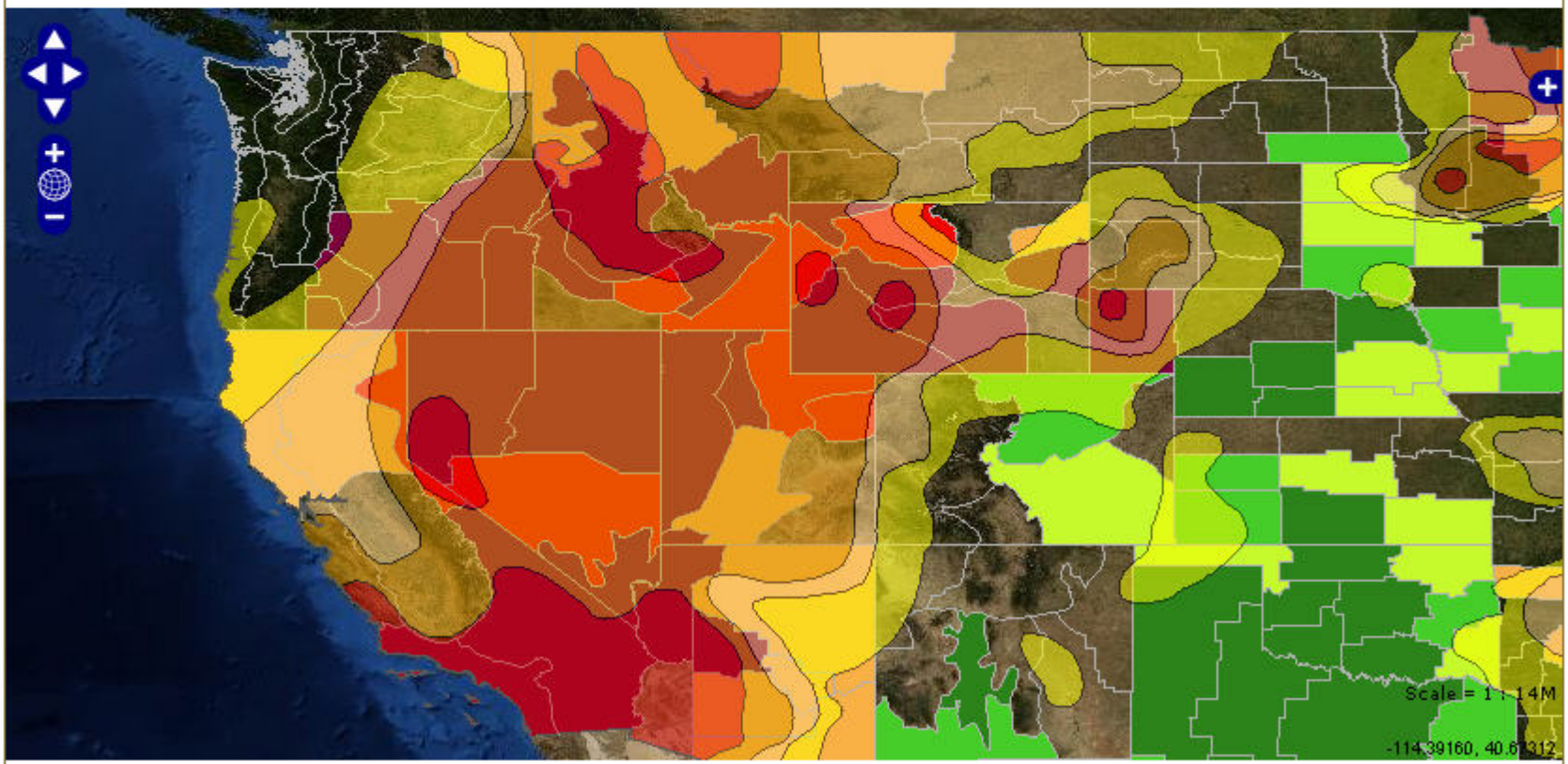
View Divisional Data Layers By: Climate Division



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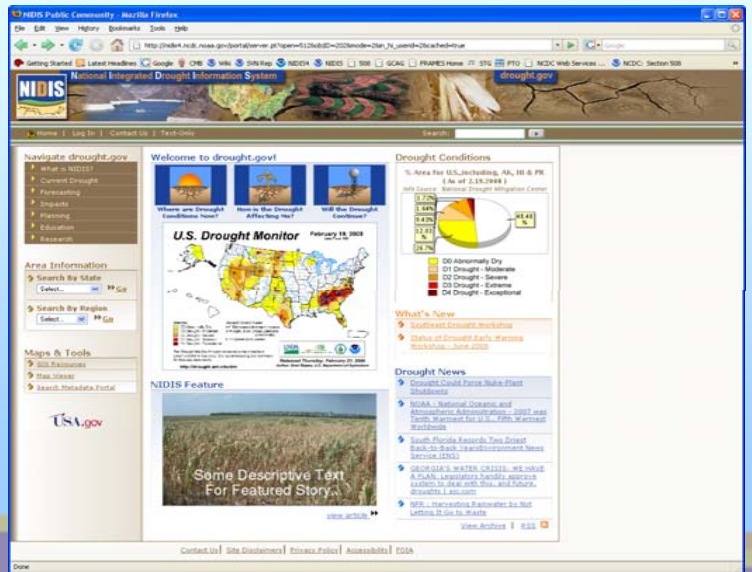
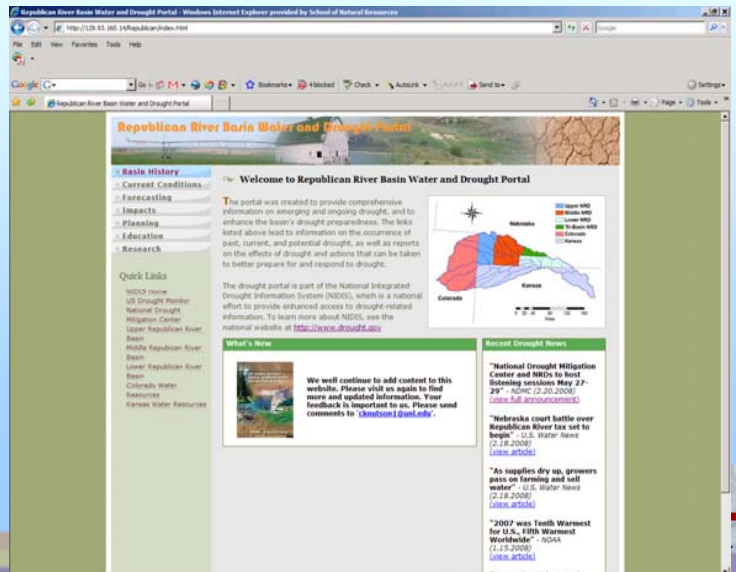
Future Work: Phase 2 and Beyond…

- Enhanced content and linkages
- GIS capabilities
- Community collaboration tools and features
- Links to emerging early warning networks and products (SM, satellite, etc.)
- Link to Local or Basin-Level drought portals
- Potential for data and information/management sharing cross-agency and at all levels





Summary

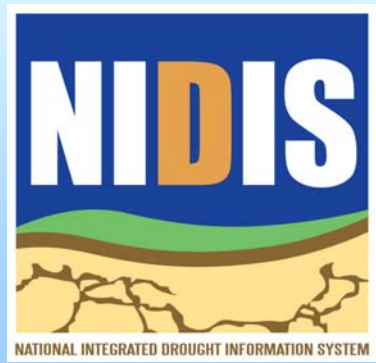
NIDIS' U.S. Drought Portal Provides a Window for Interagency Data Collaboration and Dissemination

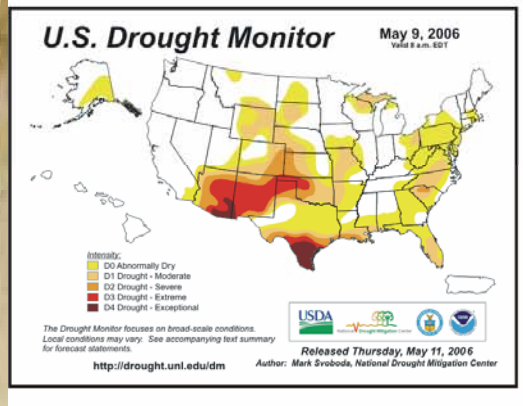
- The initial phase of the USDP (November 2007) will allow drought experts and general users to answer key questions about drought on an end-to-end basis.

A drought early warning system needs to get down to the local level:

- preparedness, response, mitigation, and recovery from drought that affect such societal issues as water management, agriculture, human health, energy, and many others

A Republican Basin Drought Portal will be one of the first basin (local) portals designed and built to be integrated with the national NIDIS Portal!

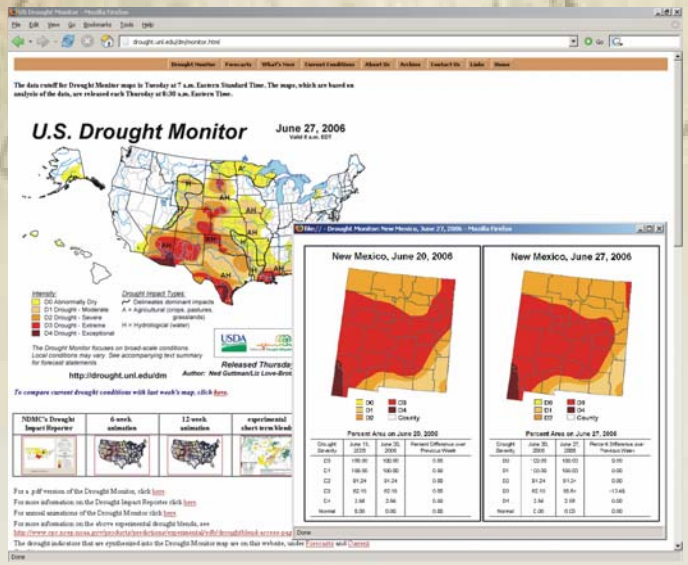




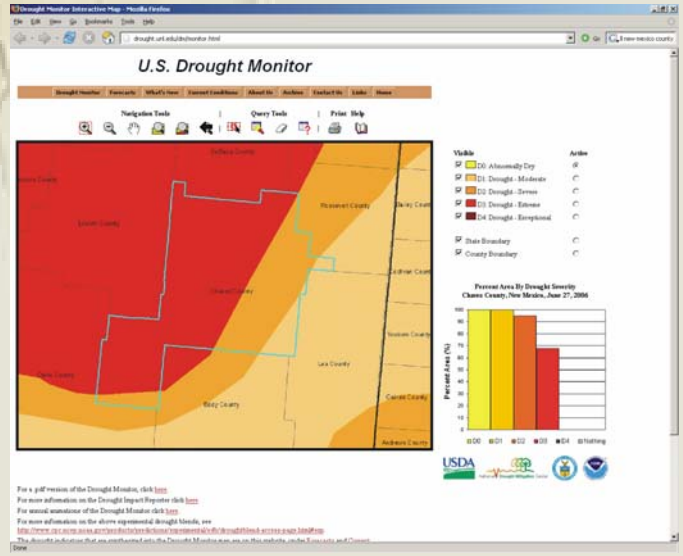
Drought Monitor Decision Support System (DM-DSS):

A Web-based Assessment Tool for Decision Makers

Mark Svoboda, Brian Fuchs, Dr. Michael Hayes, Dr. Jae Ryu, Soren Scott, and Ian Cottingham



Moving toward state-level trend analysis capabilities (left) and providing more county-level drought assessment information (right).



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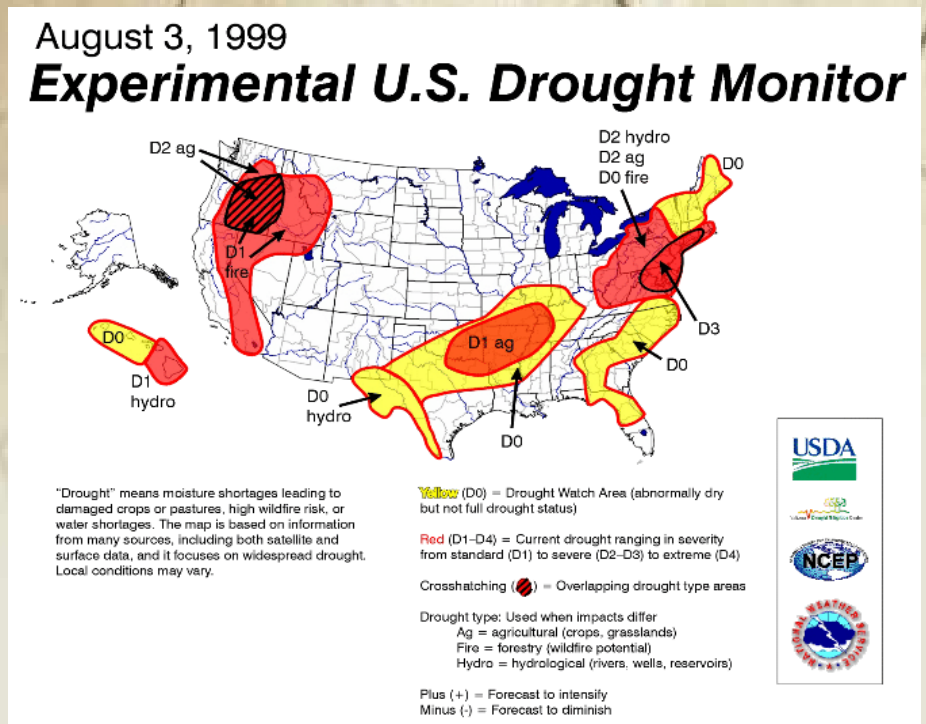
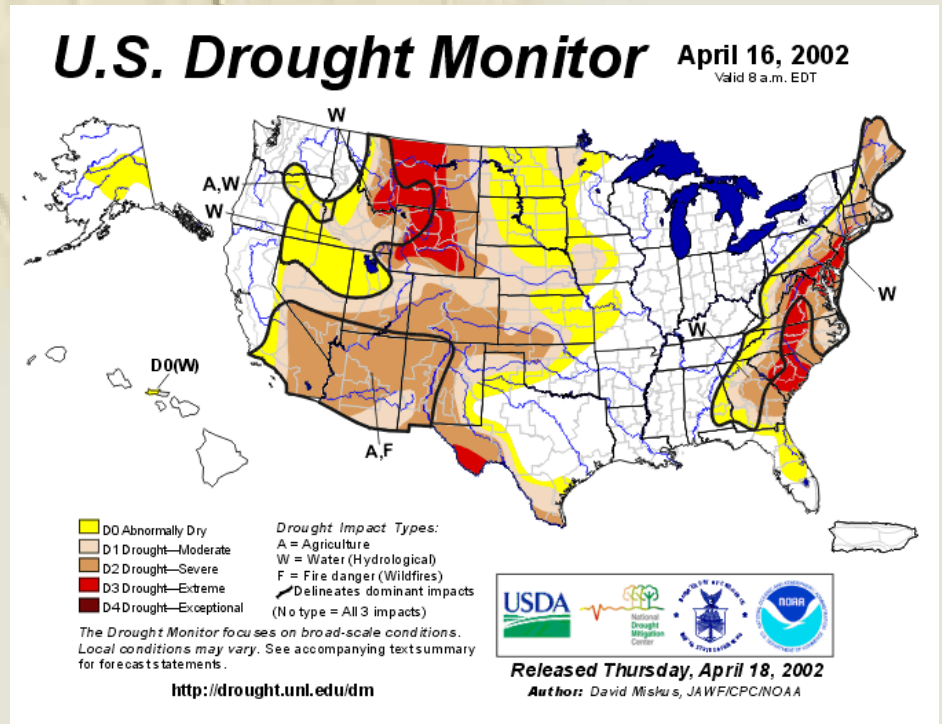
National Drought Mitigation Center

RMA

The U.S. Drought Monitor

Since 1999, NOAA (CPC and NCDC), USDA, and the NDMC have produced a weekly composite drought map -- the U.S. Drought Monitor -- with input from numerous federal and non-federal partners





U.S. Drought Monitor

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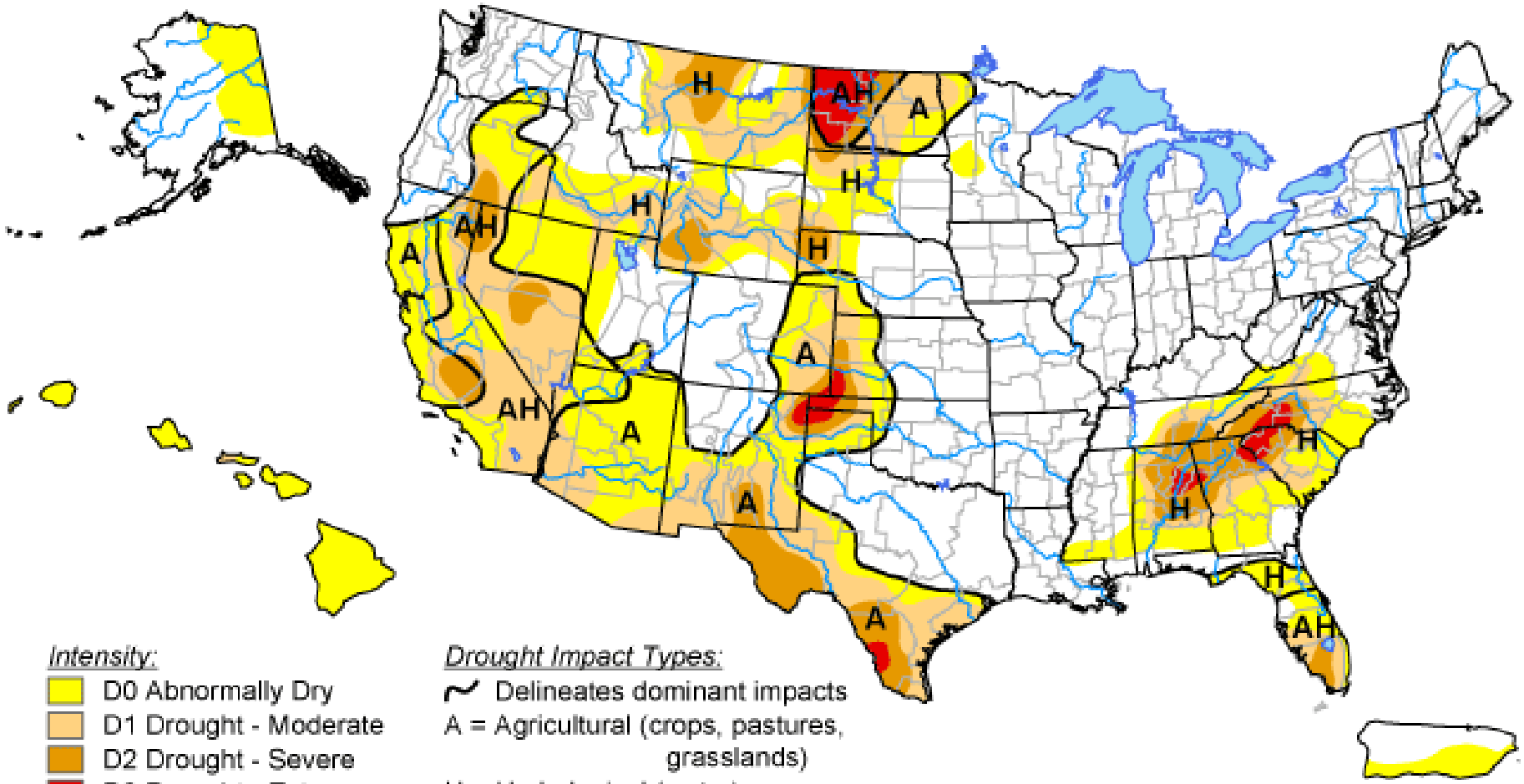

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http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, May 22, 2008

Author: David Miskus, JAWF/CPC/NOAA

The Drought Monitor Concept

- A ***partnership*** between the NDMC, USDA and NOAA's CPC and NCDC ***(authors)***

- Incorporate relevant information and products from all entities (and levels of government) dealing with drought (RCC's, SC's, federal/state agencies, etc.) ***(experts)***

- The **Drought Monitor** is ***updated weekly*** and provides a general up-to-date summary of current drought conditions across the 50 states, Puerto Rico and the Pacific possessions

Recent Drought Losses in the United States

1988: $39.2 billion nationwide

1993: $1 billion across the Southeast

1996: $10 billion across the Southwest

1998: $6-8 billion across the South

1999: $1.2 billion along the East Coast

2000: $4.8 billion across the Plains and South

2002: >$11.4 billion across 30 states

2006: >$6.2 billion across the U.S.

2007: >$5.0 billion across Southeast and Plains

Average annual losses: $6-8 billion (FEMA)

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National Drought Mitigation Center

Original Objectives

- "Fujita-like" scale
- Assessment of current conditions
- ***NOT*** a forecast!
- ***NOT*** a drought declaration!
- Identify impacts (A, H)
- Incorporate local expert input
- Be as objective as possible

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National Drought Mitigation Center

U.S. Drought Monitor

Integrates Key Drought Indicators:

- Palmer Drought Index
- SPI
- KBDI
- Modeled Soil Moisture
- 7-Day Avg. Streamflow
- Precipitation Anomalies

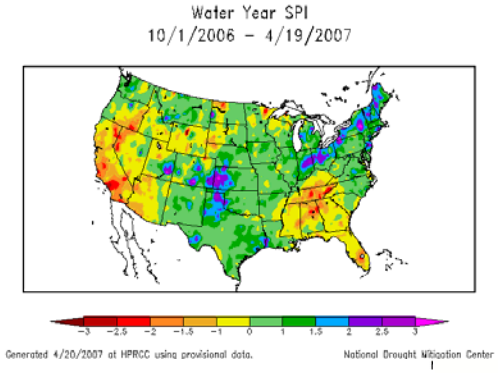
Growing Season:

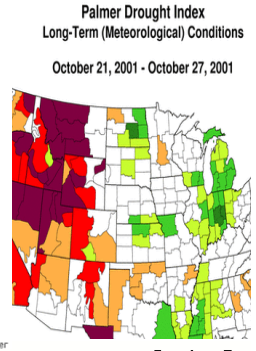
- Crop Moisture Index
- Sat. Veg. Health Index
- Soil Moisture
- Mesonet data

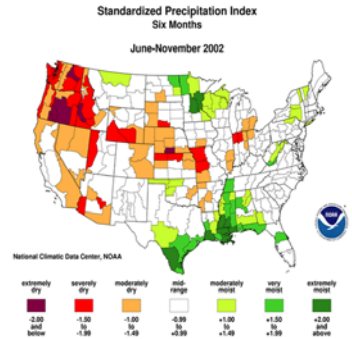
In The West:

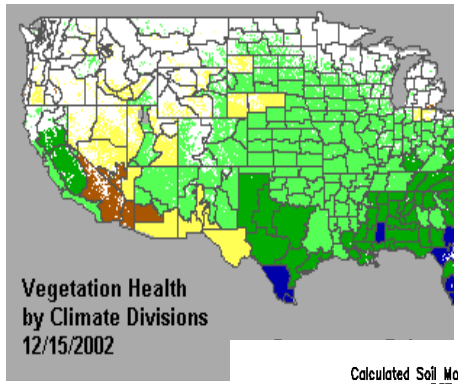
- SWSI
- Reservoir levels
- Snowpack
- Streamflow

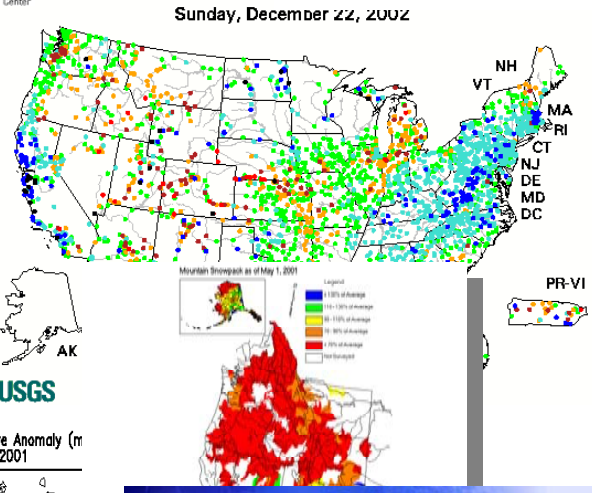
Created in ArcGIS

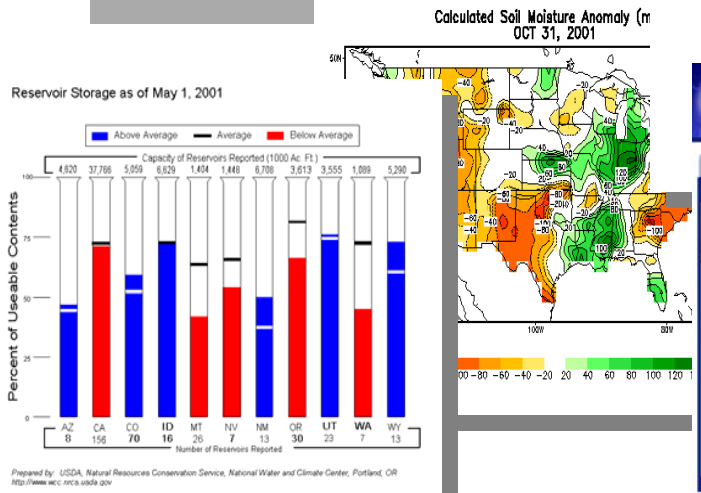


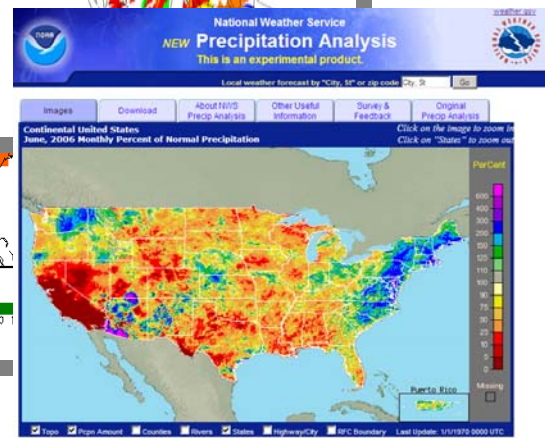












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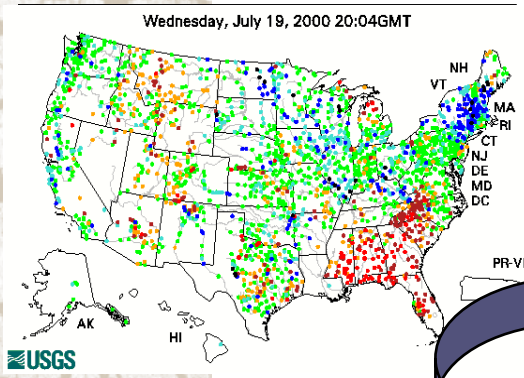
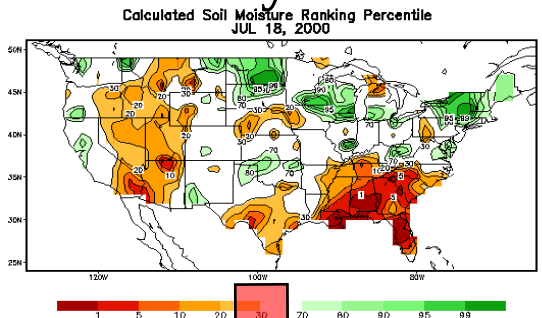
Principal Drought Monitor Inputs

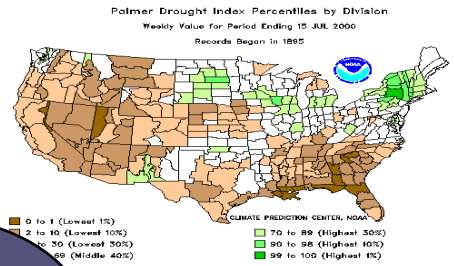
USGS Streamflow



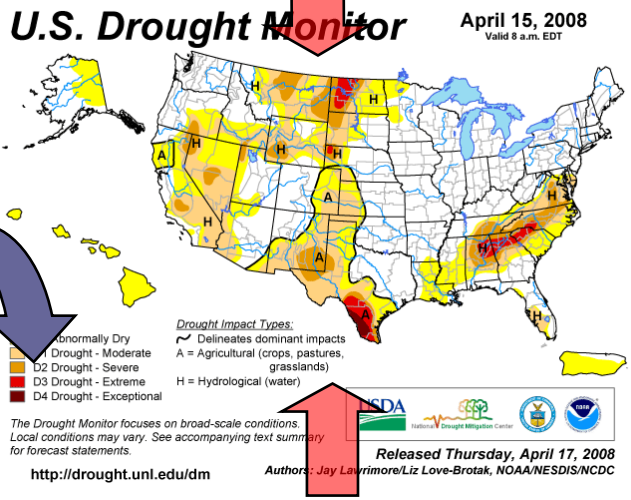
CPC Daily Soil Model



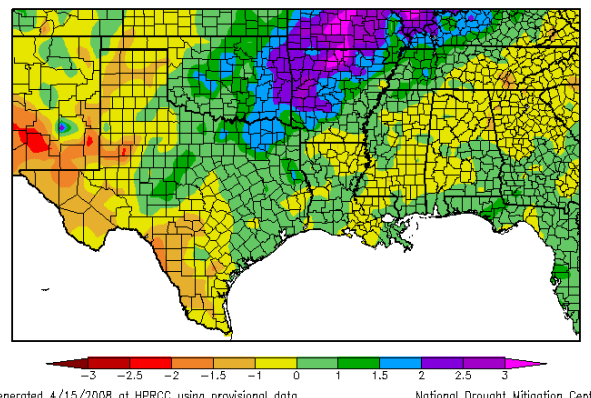
Palmer Drought Index



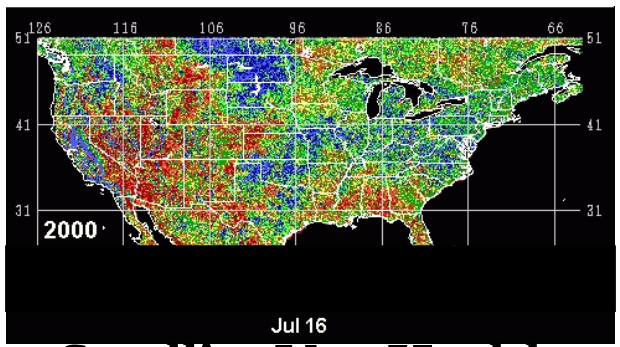
U.S. Drought Monitor



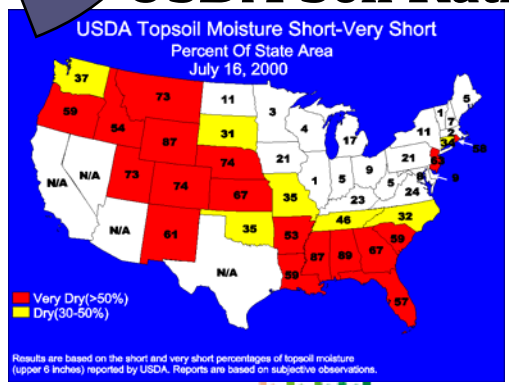
SPI Drought Index



Satellite Veg Health



USDA Soil Ratings



National Drought Mitigation Center

Drought Monitor Development *(Period starts 12Z last Tuesday)*

Monday (5 Days available)

✓Draft map sent to local experts

Tuesday (6 Days available)

✓Local expert feedback

✓Draft map sent to local experts

✓Draft text sent to local experts

Wednesday (7 Days available; ending 12Z yesterday)

✓ Local expert feedback
✓ Draft map(s) sent to local experts
✓ Draft text(s) sent to local experts (Outlook)
✓ Final map and text sent to secured ftp server

Thursday

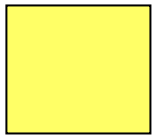
✓Final map & text released on NDMC Website

University of Nebraska Lincoln

National Drought Mitigation Center

U.S. Drought Monitor Map

Drought Intensity Categories



D0 **Abnormally Dry (30%tile)**

D1 Drought – **Moderate (20%tile)**

D2 Drought – **Severe (10%tile)**

D3 Drought – **Extreme (5%tile)**

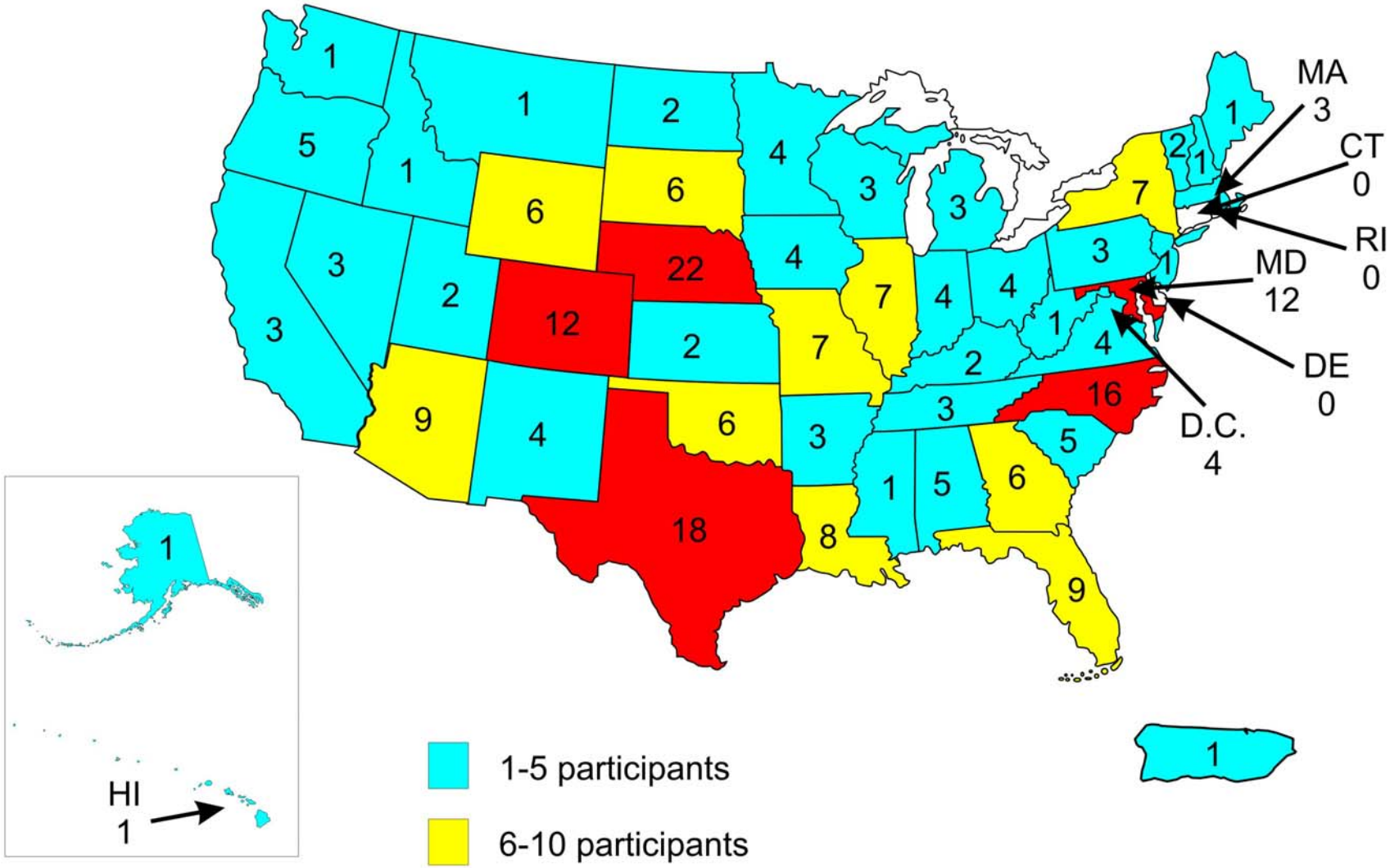
D4 Drought – **Exceptional (2%tile)**

University of Nebraska Lincoln

National Drought Mitigation Center

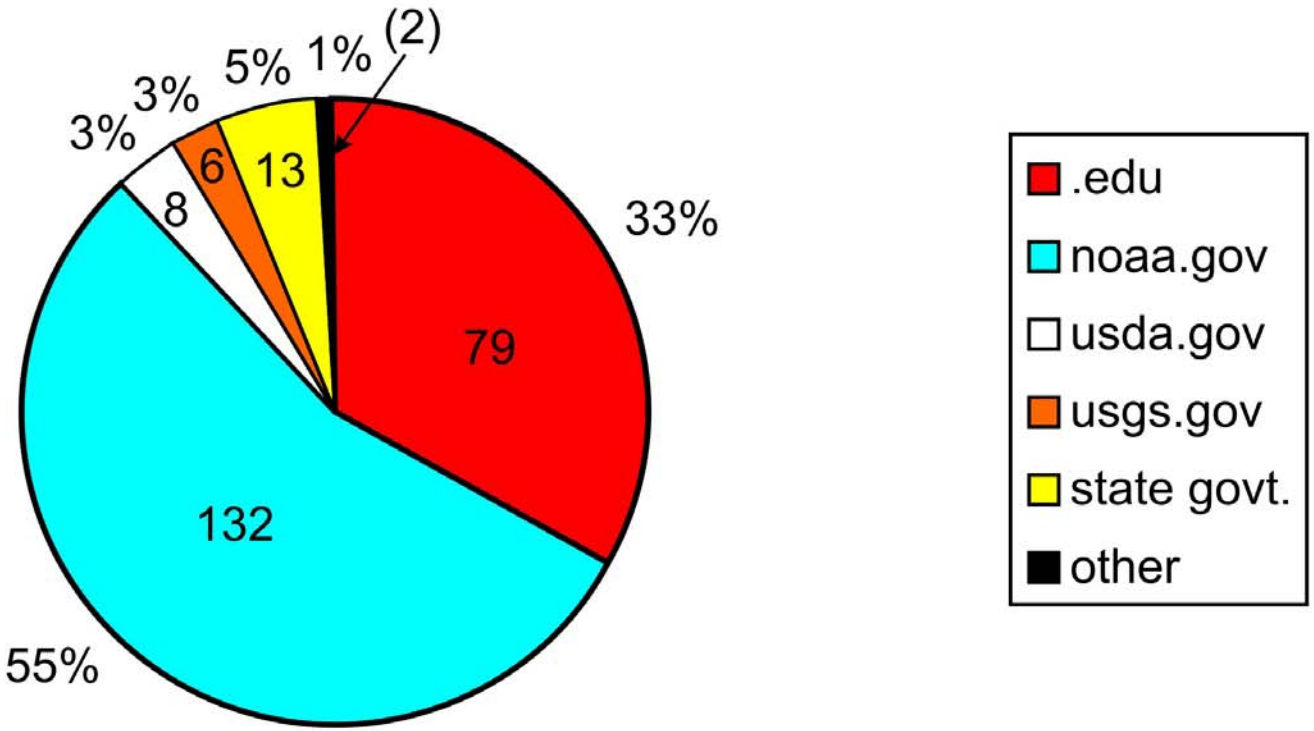
USDM Listserve Participants

(as of January 24, 2007)



USDM Listserve Participants

(as of January 24, 2007)



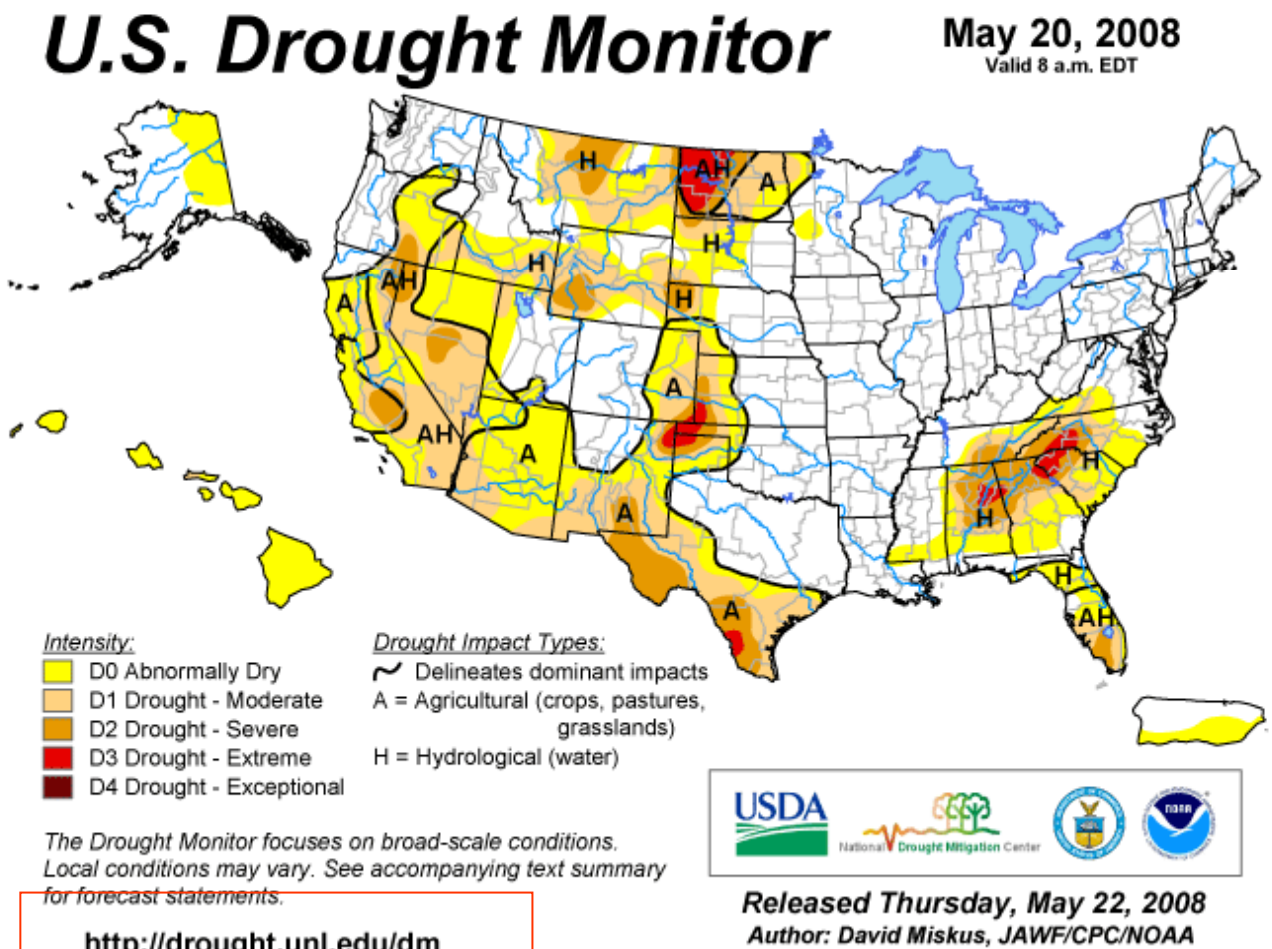
University of Nebraska Lincoln

National Drought Mitigation Center

Visit the NDMC Photo Gallery to see photos of drought conditions in California, Georgia, South Carolina, and other states. If you have photos showing drought conditions, please consider submitting them to the Photo Gallery.

The data cutoff for Drought Monitor maps is Tuesday at 7 a.m. Eastern Standard Time. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.

NOTE: To view regional drought conditions, click on map below. State maps can be accessed from regional maps.

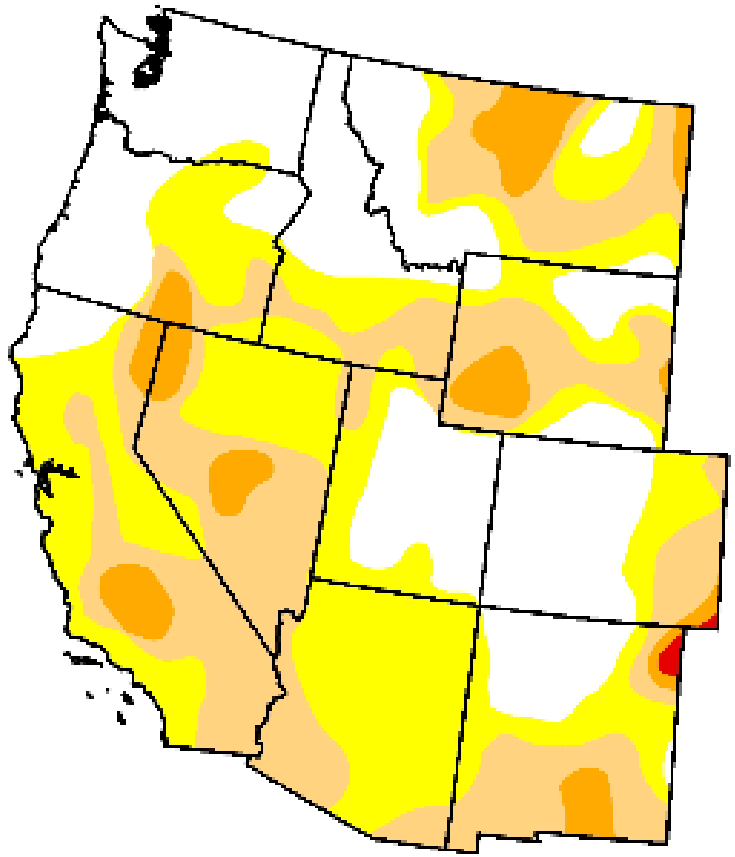


U.S. Drought Monitor
West

May 20, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	32.8	67.2	34.5	6.8	0.2	0.0
Last Week (05/13/2008 map)	33.4	66.6	35.8	6.2	0.0	0.0
3 Months Ago (02/26/2008 map)	37.8	62.2	37.0	16.6	0.0	0.0
Start of Calendar Year (01/01/2008 map)	26.3	73.7	54.7	33.1	2.7	0.0
Start of Water Year (10/02/2007 map)	22.0	78.0	62.3	44.7	12.4	0.0
One Year Ago (05/22/2007 map)	30.9	69.1	51.2	24.4	7.5	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, May 22, 2008

Author: David Miskus, JAWF/CPC/NOAA

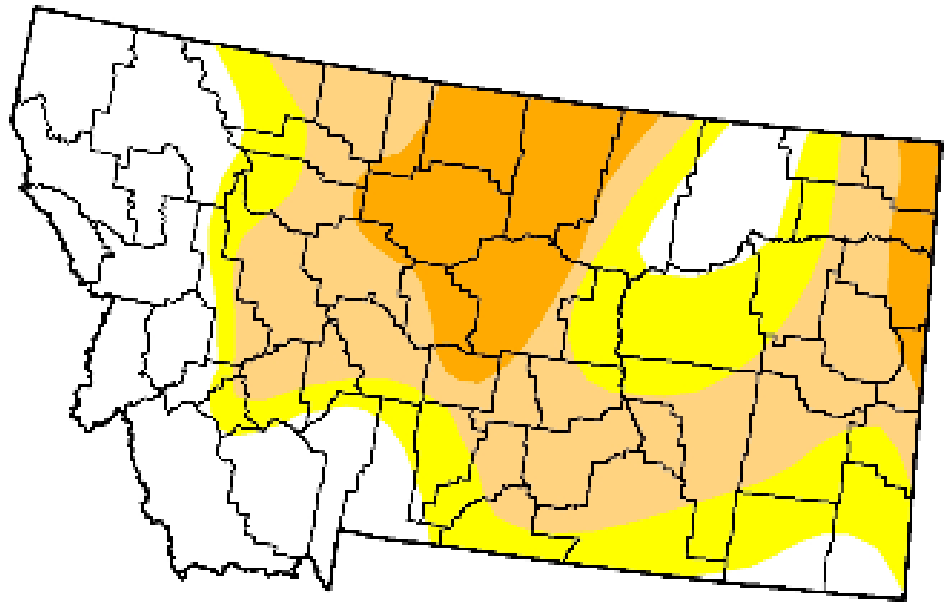
U.S. Drought Monitor

Montana

May 20, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	31.0	69.0	45.7	14.7	0.0	0.0
Last Week (05/13/2008 map)	25.3	74.7	54.9	14.7	0.0	0.0
3 Months Ago (02/26/2008 map)	21.8	78.2	51.0	9.0	0.0	0.0
Start of Calendar Year (01/01/2008 map)	0.8	99.2	61.2	26.4	0.0	0.0
Start of Water Year (10/02/2007 map)	3.9	96.1	88.3	46.2	9.5	0.0
One Year Ago (05/22/2007 map)	54.2	45.8	17.4	0.0	0.0	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, May 22, 2008

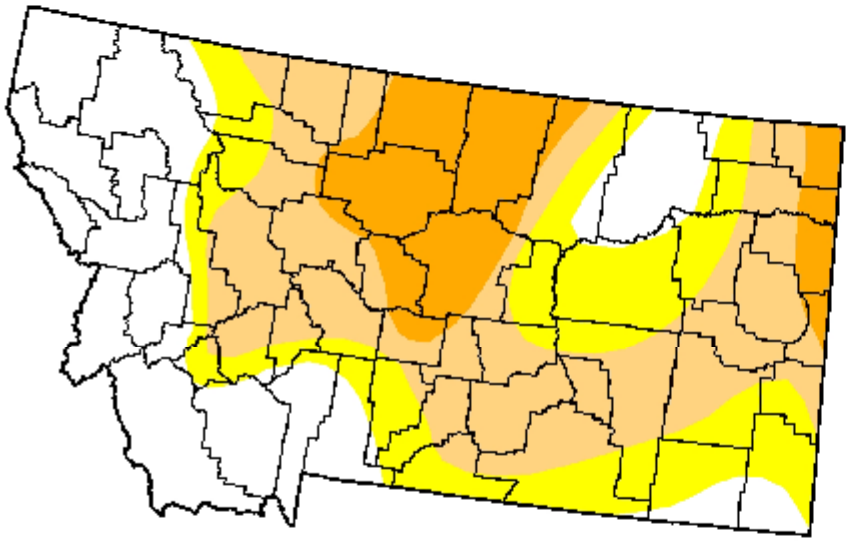
Author: David Miskus, JAWF/CPC/NOAA

Contiguous United States | Region: Northeast | State: Montana | Update

Drought Severity

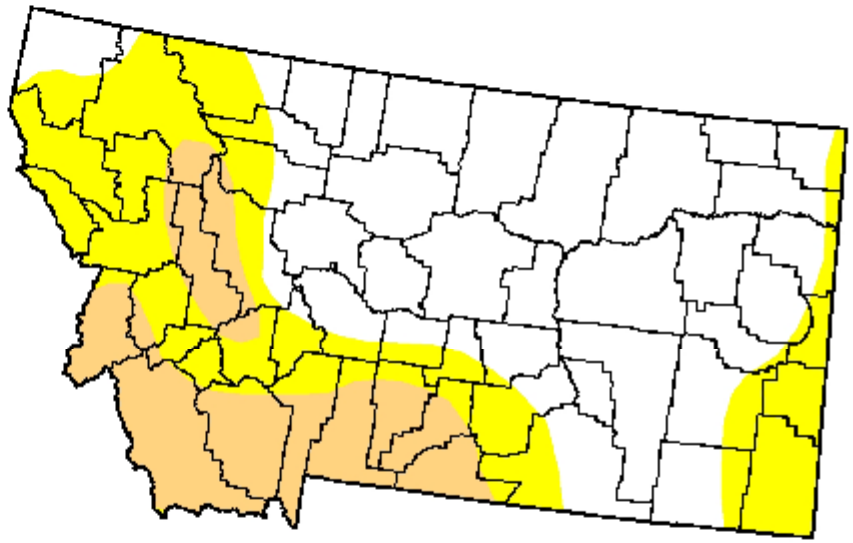
D0 Abnormally Dry | D1 Drought - Moderate | D2 Drought - Severe | D3 Drought - Extreme | D4 Drought - Exceptional

May 20, 2008



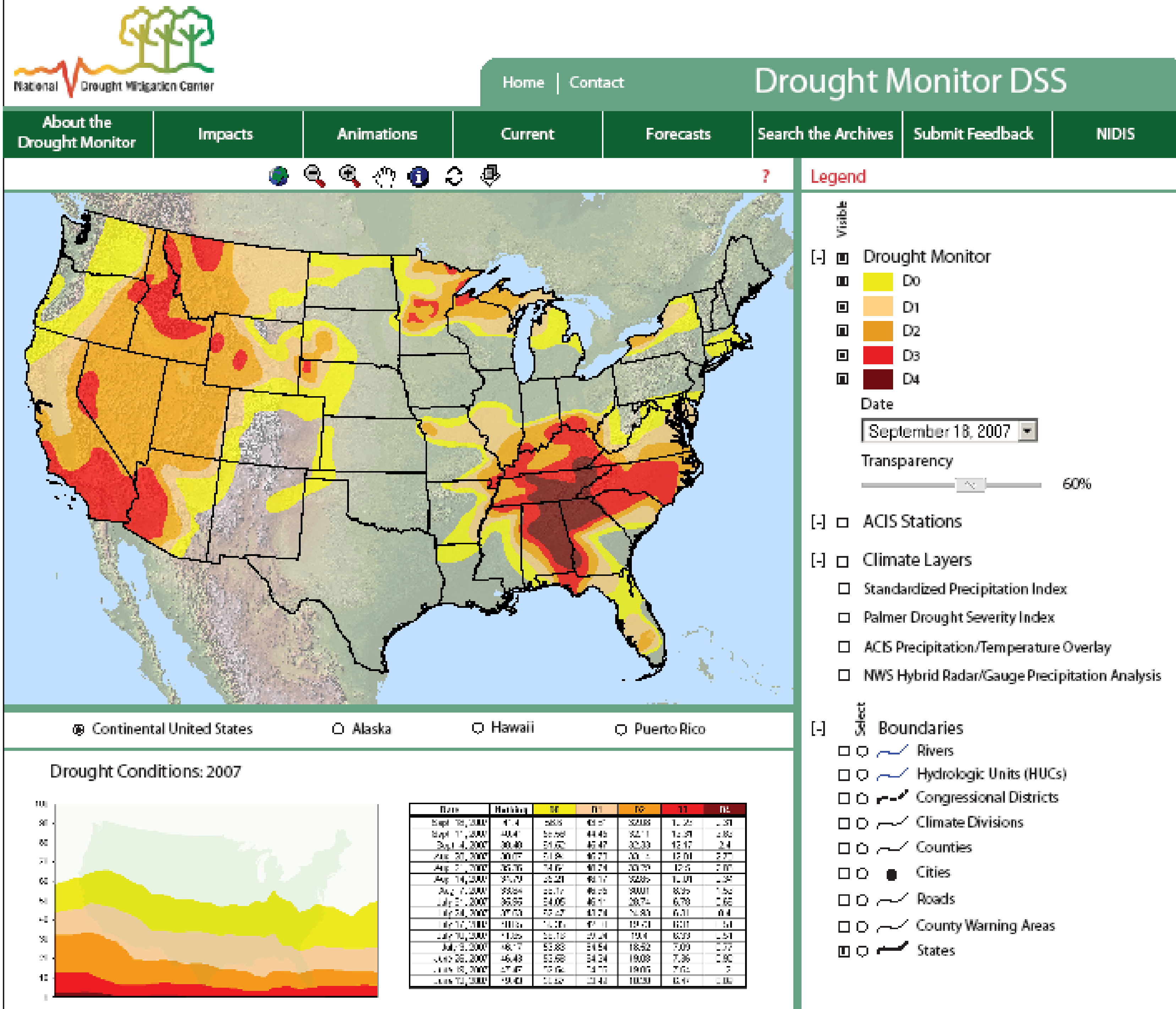
Download image or PDF
Read the summary

May 22, 2007



Download image or PDF
Read the summary

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
05/20/08	31.03	68.97	45.68	14.69	0.01	0.00
05/22/07	54.20	45.80	17.39	0.00	0.00	0.00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D0
D1
D2
D3
D4
Date
September 18, 2007
Transparency
60%
[-] ACIS Stations
[-] Climate Layers
Standardized Precipitation Index
Palmer Drought Severity Index
ACIS Precipitation/Temperature Overlay
NWS Hybrid Radar/Gauge Precipitation Analysis
Select
[-] Boundaries
Rivers
Hydrologic Units (HUCs)
Congressional Districts
Climate Divisions
Counties
Cities
Roads
County Warning Areas
States
Continental United States
Alaska
Hawaii
Puerto Rico
Drought Conditions: 2007

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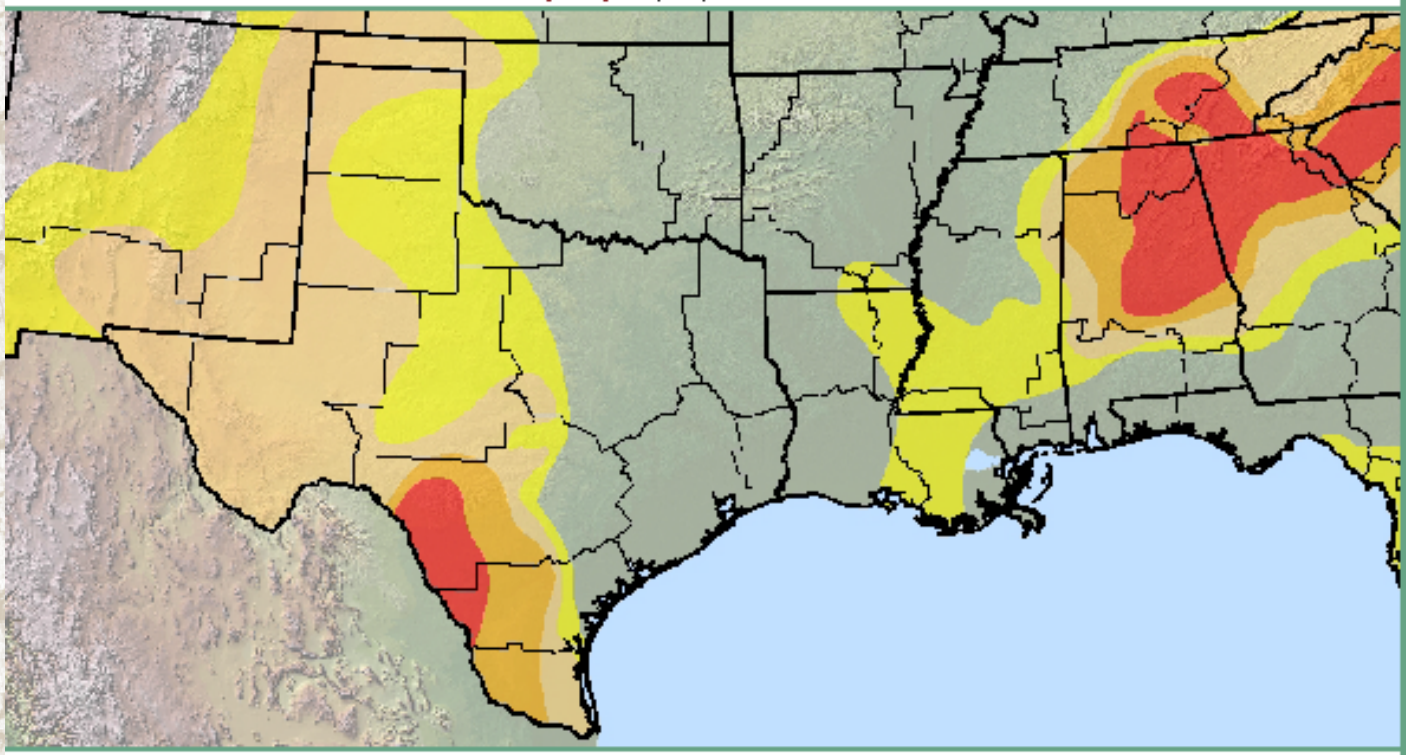
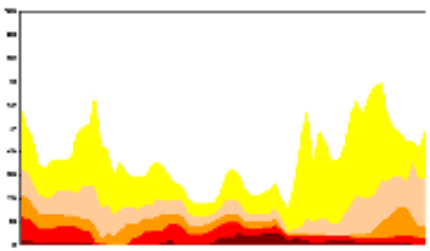


○ Continental United States ○ Alaska ○ Hawaii ○ Puerto Rico

Drought Conditions: January 2007-April 2008



Week	Nothing	D0	D1	D2	D3	D4
April 1, 2008	51.02	48.99	28.51	8.13	3.17	0.00
March 25, 2008	58.11	41.89	28.71	8.13	3.51	0.00
March 18, 2008	55.69	44.31	35.53	11.78	3.90	0.49
March 11, 2008	55.43	44.57	26.85	16.16	3.90	1.28
March 4, 2008	51.63	48.37	29.65	16.72	3.66	1.34
February 26, 2008	49.91	50.09	29.50	14.11	3.79	1.37
February 19, 2008	43.93	56.07	27.82	11.83	3.63	1.49
February 12, 2008	30.16	69.84	27.53	10.42	2.92	1.50
February 5, 2008	31.89	68.11	21.94	7.42	2.92	1.50
January 29, 2008	35.34	64.66	20.55	5.20	3.19	1.44
January 22, 2008	43.28	56.72	20.47	4.59	3.10	1.43

Legend

Visible

[-] Drought Monitor
- D0
- D1
- D2
- D3
- D4

Date: April 01, 2008

Transparency: 40%

[-] ACIS Stations

[-] Climate Layers
- Standardized Precipitation Index
- Palmer Drought Severity Index

[-] Boundaries (Select)
- Rivers
- Hydrologic Units (HUCs)
- Congressional Districts
- Climate Divisions
- Counties
- Cities
- Roads
- County Warning Areas
- States

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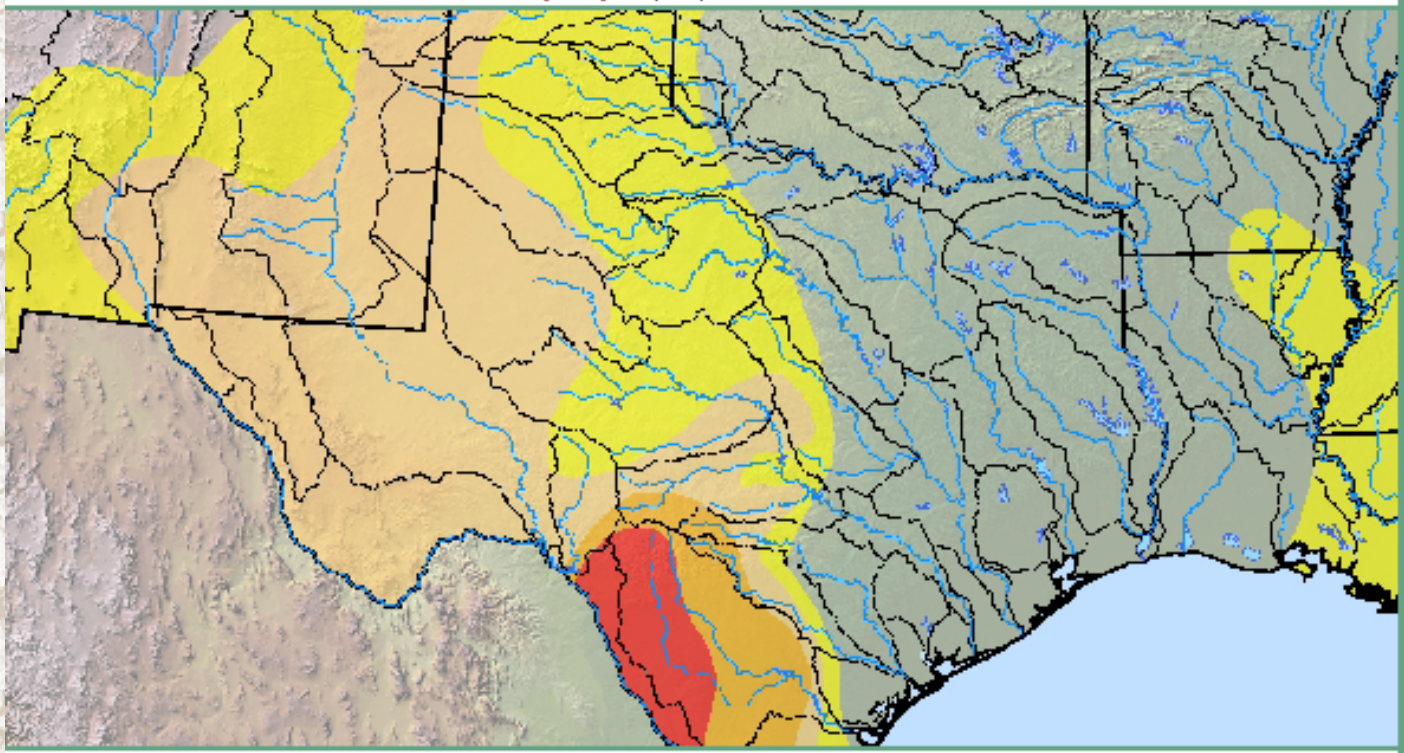

Continental United States | Alaska | Hawaii | Puerto Rico

Legend

Visible

[-] Drought Monitor
- D0
- D1
- D2
- D3
- D4

Date: April 01, 2008

Transparency: 40%

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- Standardized Precipitation Index
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- Rivers
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- States

Climate Links for Texas

Southern Regional Climate Center:
http://www.srcc.lsu.edu

Bureau of Reclamation Reservoir Levels:
http://www.usbr.gov/gp/water/rflow.cfm

USGS Real-Time Streamflow Data:
http://waterdata.usgs.gov/tx/nwis/rt

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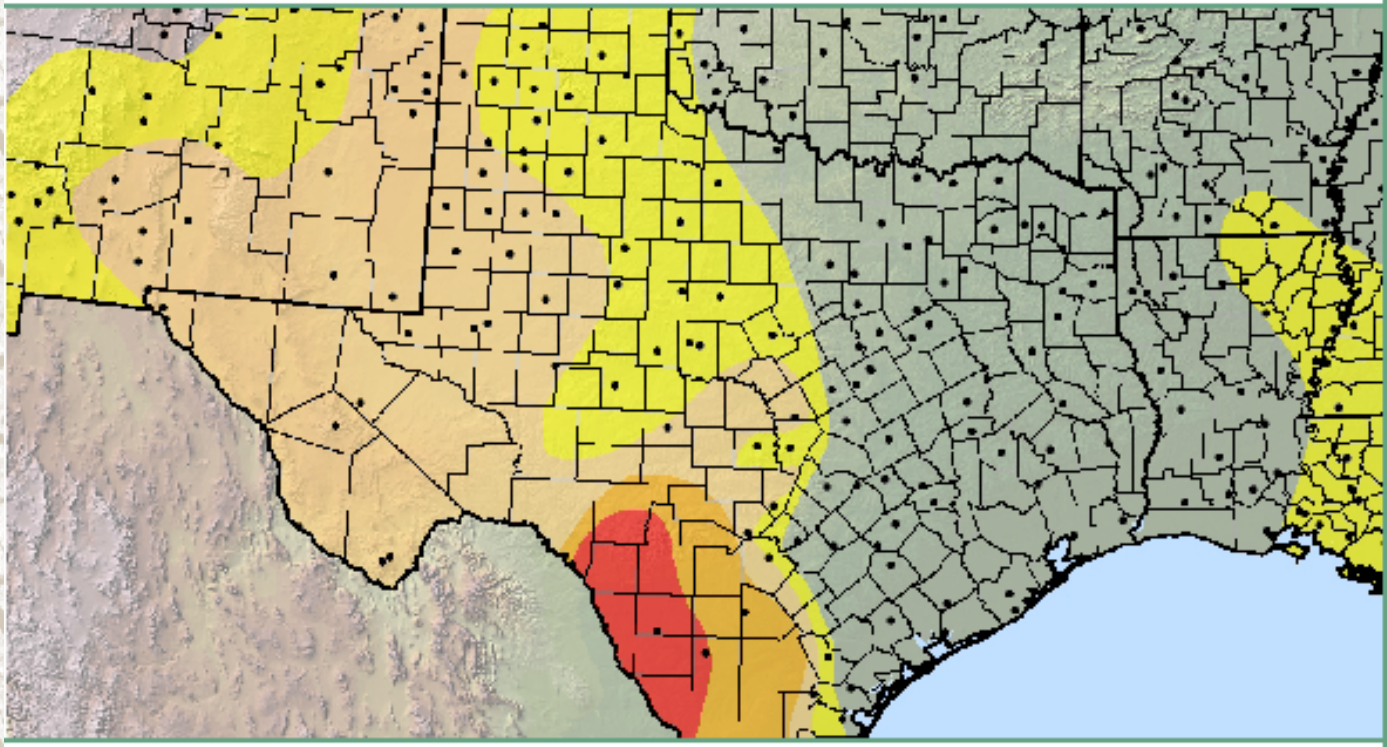

Continental United States | Alaska | Hawaii | Puerto Rico

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http://waterdata.usgs.gov/tx/nwis/rt

Legend

Visible

[-] Drought Monitor
- D0
- D1
- D2
- D3
- D4

Date: April 01, 2008

Transparency: 40%

[-] ACIS Stations

[-] Climate Layers
- Standardized Precipitation Index
- Palmer Drought Severity Index

[-] Select Boundaries
- Rivers
- Hydrologic Units (HUCs)
- Congressional Districts
- Climate Divisions
- Counties
- Cities
- Roads
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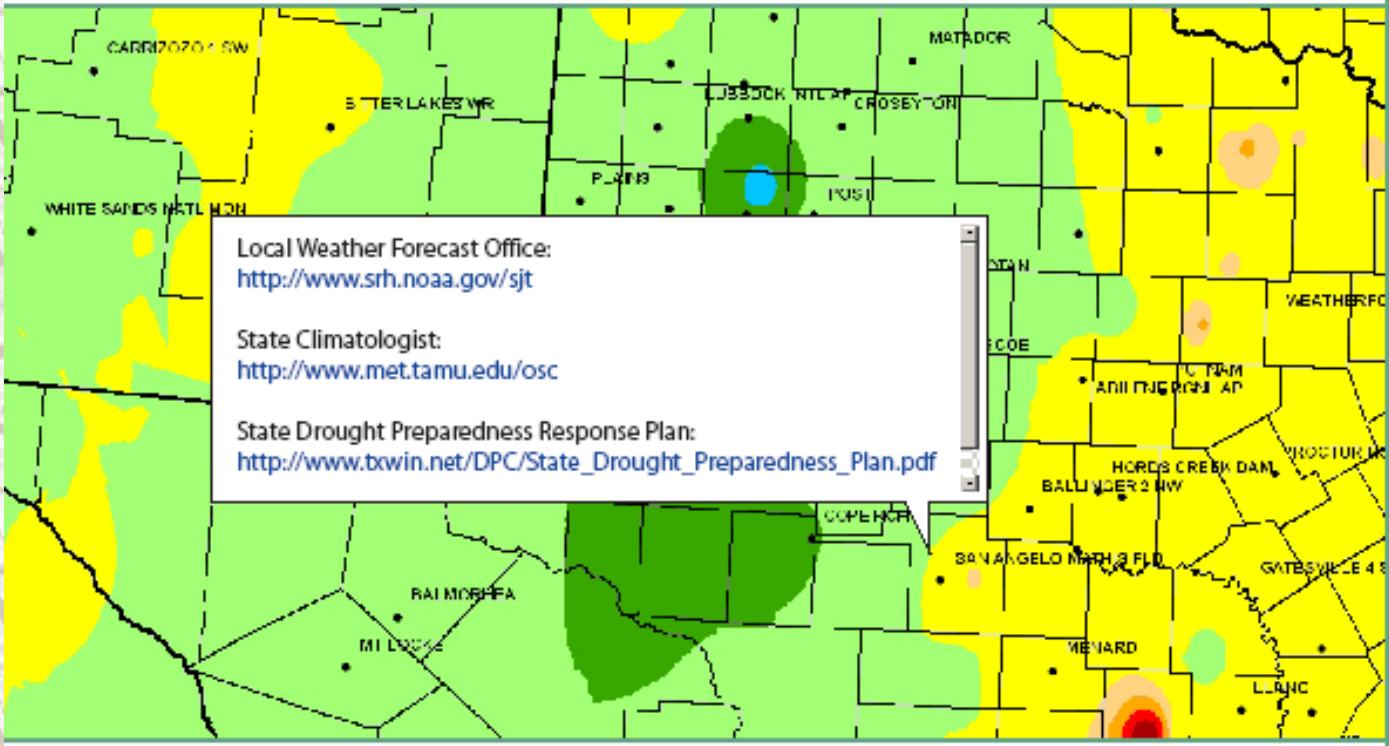
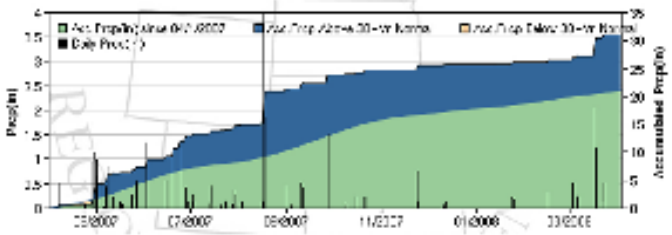


◉ Continental United States ○ Alaska ○ Hawaii ○ Puerto Rico

Precipitation: January 2007-April 2008



Drought Impacts for San Angelo ,TX

Fire Impact 1/3/2008
San Angelo,Texas—Tom Green county is one of 129 counties across Texas that have burn bans due to dry conditions as reported by the Texas Forest Service.

Legend

Visible

[+] ☐ Drought Monitor

[-] ▣ ACIS Stations

● Station Name

[-] ▣ Climate Layers

▣ Standardized Precipitation Index

- < -3
- -3 to -2.5
- -2.5 to -2
- -2 to -1.5
- -1.5 to -1
- -1 to 0
- 0 to 1
- 1 to 1.5
- 1.5 to 2
- 2 to 2.5
- 2.5 to 3
- > 3

☐ Palmer Drought Severity Index

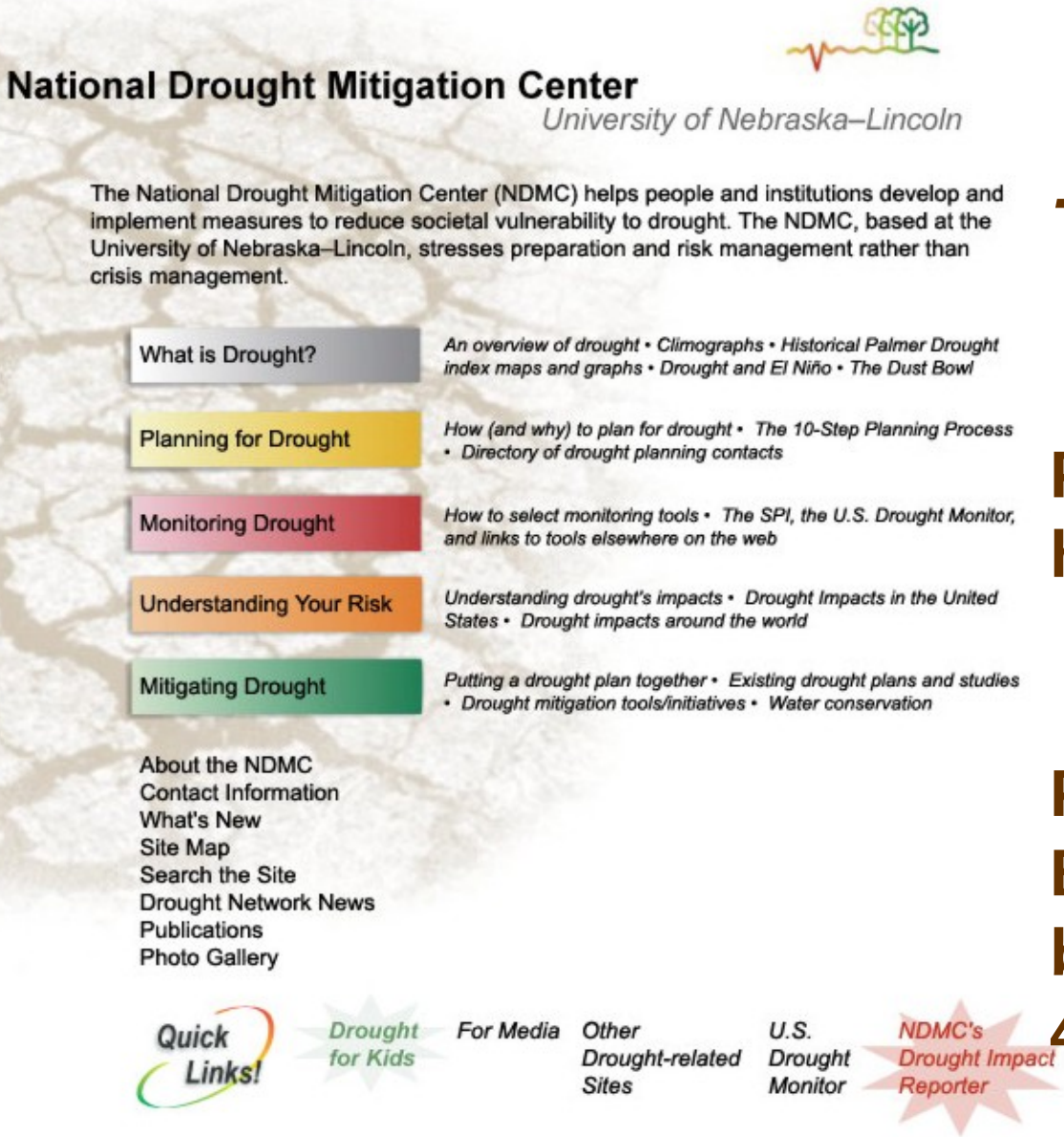
Select

[-] Boundaries

- ☐ ○ Rivers
- ☐ ○ Hydrologic Units (HUCs)
- ☐ ○ Congressional Districts
- ☐ ○ Climate Divisions
- ▣ ○ Counties
- ☐ ○ Cities
- ☐ ○ Roads
- ☐ ○ County Warning Areas

Use of the DM in Decision Making

- USDA Dried Milk Program 2002-03
- USDA CRP Release hot spot trigger
- Numerous states use as a drought trigger (Governor's declarations)
- 2006 USDA Livestock Assistance
- 2006 IRS (tax deferral on livestock losses)



Thank you!

Please visit us at:
http://drought.unl.edu/

Please contact me at:
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bfuchs2@unl.edu
402-472-6775

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National Drought Mitigation Center

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